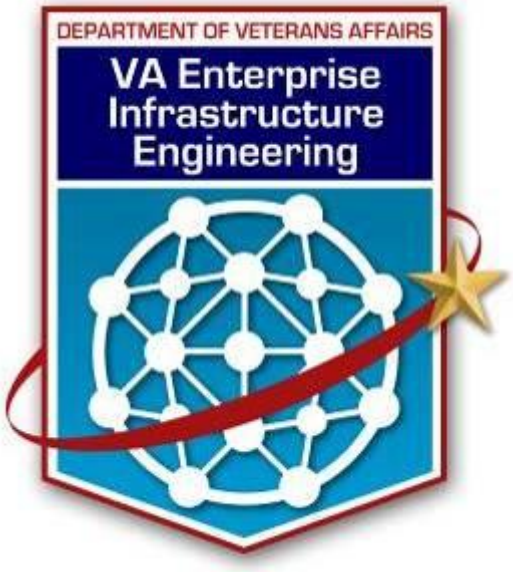
DEPARTMENT OF VETERANS AFFAIRS



OFFICE OF INFORMATION AND TECHNOLOGY

ENTERPRISE INFRASTRUCTURE ENGINEERING

VA Enterprise IT Infrastructure Standard

Storage/SAN/Backup

Production v1.0

November 18, 2009

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1 INTRODUCTION

1.1 PURPOSE

A standard is a set of rules or requirements that are determined by a consensus opinion of subject matter experts and prescribe criteria for a product, process, test or procedure. The general benefits of a standard are quality, interchangeability of parts or systems, and consistency. Information Technology (IT) standards are based on business needs provided through or supported by IT Services. IT Services are designed to support business processes and are constructed from software, hardware and infrastructure components. Establishing and enforcing standards for the selection and configuration of these supporting components improves the maintainability, reliability and availability of IT Services within projected economic constraints in alignment with business needs.

This standards document lists the acceptable and recommended specifications for general and mission critical backend storage devices, storage area network, and backup solution. Sections include standard specifications for subject components, decisions supporting the standard specifications, guidelines or recommendations for implementing the standard specifications, and supplemental factors to consider when evaluating subject components. Other supplementary documents will provide guidance on procuring components that meet the standard specifications, guidance on integrating them with existing components, and explanation of how the subject components fit into the VA Architecture.

1.2 OBJECTIVES

This standard provides acceptable and recommended specifications to support:

- Solution Evaluation
- Requirement Evaluation
- Solution Design
- Solution Procurement and Bid Evaluation
- Evaluation of Architectural Specifications
- Provide vendor neutral or vendor specific where justified, for general and mission critical application backend storage devices, storage area network, and backup solution.

1.3 SCOPE

This standard applies to:

- These specifications are for new equipment targeting small facilities to regional data centers.
- Specifications will include all attributes necessary to specify general and mission critical application backend storage device, storage area network, and backup standard.

2 STANDARDS

2.1 [TIER 1 STORAGE SERVICE]

Tier 1 Services – Storage device supporting High and Extreme high Performance workloads.

ID	*Primary Attribute*	*Secondary Attribute*	*Specification*
1	Storage Subsystem Hardware (HW)	Workload	Capable to support Extreme High and High Workload such as OLTP databases (Cache/IDMS/Oracle/SQL) with 25,000 or more concurrent users
		Minimum IO/sec	100,000 SPC-1 IOPS™ as measured by SPC-1 benchmark (http://www.storageperformance.org/results/)
		Minimum Throughput	5,000 SPC-2 MBPS™ as measured by SPC-2 benchmark (http://www.storageperformance.org/results/)
		Storage unit uptime	5’9s uptime.
		Universal Device ID value (UDID)	Changeable LUN UDID value is required.
		Redundancy	Fully redundant power supplies, cooling fans, component controllers, and others. All controllers within a single module will automatically fail over and load balance with one another. Controller module will support a minimum of two controllers.
		FC - Hosts to Storage Connectivity	Storage subsystems must support minimum four 4-Gbit/s Fiber Channel ports. Ability to support ports expansion to meet Tier 1 performance requirements in the same unit(s).
			Minimum two redundant multi-path connections from Host to Storage device. The Host connectivity throughput and performance will not be degraded even if 50% of the Host connectivity is lost.
		iSCSI - Hosts to Storage Connectivity	Storage subsystems must support minimum 1 Gb Ethernet connectivity with link aggregation. 10 Gb Ethernet support is preferred. Controller module will

ID	*Primary Attribute*	*Secondary Attribute*	*Specification*
			support a minimum of four Ethernet ports. Ability to support ports expansion in the same unit(s). Support Jumbo frame and LACP protocol.
			Minimum two redundant multi-path connections from Host to Storage device. The Host connectivity throughput and performance will not be degraded even if 50% of the Host connectivity is lost.
		FICON connectivity	Storage subsystems must support FICON connectivity
		SCSI Initiator (Host Connections)	Support a minimum of 256
		Replication	Capable of synchronous and asynchronous replication with write order fidelity.
		LUN creation	Ability to create LUN across all spindles.
		LUN Expansion	Dynamic LUN expansion is required.
		Storage provisioning	Capable of over-provisioning or Over-allocation storage capacity that allows hosts to view more storage capacity than has been physically reserved on the storage array itself
		Tiering capability	Using policies to move inactive data to lower tier of storage
		Resource partitioning capability	Capable of isolating subsystem resources (such as Cache, Ports, CPU and Disk) and dedicate to particular host.
		Dynamically tuning	Dynamically tune and optimize storage subsystem components such as cache memory, disk, I/O ports in a single storage system is required.
		Backend Storage virtualization	Capable to connect other backend storage devices.
		Snapshots	Capable of creating point in time delta snapshot Capable of creating space efficient snapshots on an as needed basis versus snapshot space reservation
		Clones	Capable of creating point in time delta clone

ID	Primary Attribute	Secondary Attribute	Specification
			Capable of creating space efficient clones on an as needed basis versus snapshot space reservation. Immediate access to clones before it is completed.
		Storage device scale up capability	Ability to upgrade controller/controller module on storage device without forklift upgrade.
			Adding or upgrading storage subsystem components adhering to the required storage device uptime requirement and no data migration
		Supported Disk type	Ability to support sufficient disk drive technologies to meet Tier 1 performance requirements.
		Return disk option	Non-return disk option is required
		Interoperability - Industry standards	Each storage subsystem must provide Storage Management Initiative Specification (SMI-S) 1.1 conforming provider (http://www.snia.org/ctp/conformingproviders)
		Firmware and microcode upgrade or updates	Completely non-disruptive to operations firmware and microcode upgrade or updates for all components with zero downtime are required.
		Boot from SAN	Storage subsystem will support boot from San.
		Operating system and file system compatibility	Must support operating systems and their associated file systems as listed in the TRM.
		Applications compatibility (minimum)	Applications listed by VA Technical Reference Model (TRM) for enterprise deployment.
		Redundant Array of Independent Disk (RAID) levels	Minimum support for RAID 0+1/10/5/6 in same subsystems.
		RAID group size	Vendor offering must be able to meet storage capacity without exceeding 7 TB RAID group size and without exceeding 7 data drives.
		Power switches	Master power switches must be covered to prevent inadvertent activation.
		Standardized layouts	Components must be mounted in standardized configurations for all VA installations.

ID	*Primary Attribute*	*Secondary Attribute*	*Specification*
		Additional servers	Refer to Server Standard, Section Class C Server
		Role-based access	Solution must include security configurations that support role-based access required to limit functions during normal and COOP operation.
		Documentation	Provide detail design solution documents and drawings. All design methods and calculations to achieve the performance requirements must be clearly stated in the document. All assumptions if any must be included in the design document.
2	Mainframe support	Parallel Access Volume (PAV)	Ability to support/exploit Parallel Access Volume (PAV).
		FICON support	Minimum 8-Gbit/s FICON Channel ports. Ability to support additional ports in the same enclosure
		HiperPAV support	Ability to support HiperPAV. Dynamic capabilities associated with Parallel Access Volumes.
		SMF support	Support SMF – Must have compatibility with this activity log recording feature
		Emulation types	Must be able to emulate 3390 based count key data devices.
		Solid State devices (SSD) support on Mainframe	Must be able to support solid state devices on Mainframe. Tools are needed to analyze mainframe data for SSD exploitation.
		Dynamic Channel Reconfiguration support	Must be able to support Dynamic Channel Reconfiguration.
		MIDAW support	Must be able to support MIDAW facility
		Priority I/O Queuing	Must be able to support Priority I/O Queuing
3	Storage Management Software	Enterprise license not based on capacity	Software licenses provided must be perpetual with a five-year support and update subscription, with all licenses and rights transferred to the Government at the time the installation is completed. Licenses must be transferable without limitation and provisioned as a VA enterprise license, without additional storage allocation-based charges, such as per GB or TB.

ID	Primary Attribute	Secondary Attribute	Specification
		Interoperability	Management software must be listed as a Storage Networking Industry Association (SNIA) SMI-S 1.1 conforming client. (http://www.snia.org/forums/smi/tech_programs/ctp/smi_conform/smi_client/smi_client_definitions.
		Storage Reporting	Storage reporting components suitable for use in a fee for service, chargeback environment. Automated reports of storage allocations must be capable of being generated by non-IT staff. Must support ODBC and/or JDBC connectivity.
		Automated tools for LUN provisioning	The software should have automated tools to provision a large number of Disk Groups and LUNs. Similarly, an automated solution should be provided to configure hosts with large numbers of logical disks.
		Proactive monitoring and remote notification	The management tool must be capable of proactive monitoring and remote notification of system and application health. Must support ODBC and/or JDBC connectivity.
		Single storage management console	Storage hardware must be manageable from a single storage management application.
		Additional servers	Refer to Server Standard, Section Class C Server
		Management server security	Refer to Server Standard, Section Class C Server
		Data snapshot (local)	License and annual maintenance (5 years) as required for software to support array-based point-in-time data images suitable for use for administrative tasks such as online backup & testing with no impact to source data and minimal additional space requirements.
		Performance analysis	Performance management software to monitor, analyze and report on all solution components (i.e. from host to fabric to storage). This includes storage subsystems, software operations, SAN infrastructure, replication and telecommunications. Software should

ID	*Primary Attribute*	*Secondary Attribute*	*Specification*
			be able to identify and analyze response time, and other relevant metrics to enable identification and resolution of potential bottlenecks. The tool must support OpenVMS client operating system. All management software must be ODBC and/or JDBC connectivity.
		Storage Capacity planning	The software must be able to analyze current capacity and forecasts future system requirements. The software should be able to collect component data to project future usage of the storage system.
		Local copy	License and annual maintenance (5 years) as required for software to support local array-array LUN copy/replication.
		Consistent design	All software should use identical components where possible to facilitate common updates across the solution.
4	Hardware/Software technical support	Support procedures	Documented support/escalation procedure for all components of the solution.
		Support Availability	Software support required 24x7x365 for all software provided in the solution. License and annual maintenance 3 years with 2 extension years.
			Hardware Maintenance/Support 5 yr, 24x7x365. For issue impacting production operation, Tier2 or greater phone support response should be available within the first hour and less than 4 hours response for Engineer to bring parts onsite.
		License transfer	Licenses can be transferred without limitation within the Department of Veterans Affairs.
		OEM resources	Direct access to on-line OEM vendor support incident information and tracking.
		Support Interface	All VA datacenters must have access to incident information and tracking for all VA datacenters.
		Disruptive patches	Describe any type of updates/patch that would

ID	*Primary Attribute*	*Secondary Attribute*	*Specification*
			require a hosted service outage of the solution.
		SLAs	Documented Service Level Agreements (SLAs) for support requests.
		Professional services	Include cost of any professional services for services that must be completed by the vendor.
5	Hardware/software Installation	Installation	Provide hardware/software installation, including initial configuration, Storage Area Network configuration & knowledge transfer.
		Pre-configuration	Rack mount and configure the solution (including servers and storage where possible) prior to shipping it to the VA. This minimizes the on-site installation time as well as the number of crates and boxes that must be received and tracked by VA.
		Onsite impact	All on-site activities must be conducted in such a manner as to minimize the impact to normal information systems operations.
		Necessary software/hardware	Provide all necessary hardware and software, including all necessary cables and mounting hardware to make the Solution operational, except government-furnished property (GFP) referenced in GFP section.
		Delivery	Provide inside delivery, installation and insurance of all equipment to VA datacenters. The VA does not accept delivery of the equipment until acceptance testing is passed at all VA datacenters.
		Trash	Remove all trash associated with shipping, delivery and installation.
		OS installation and security	Refer to Server Standard, Section Class C Server
6	Training	Training Length	Provide equivalent of one hour of certified vendor classroom training for every TB of raw disk provided.
		Knowledge transfer	Allow VA staffs to shadow as activities occur to ensure

ID	*Primary Attribute*	*Secondary Attribute*	*Specification*
			that VA can assume operational responsibility for the delivered solution.
		Documentation	Provide electronic copies of all materials, manuals, worksheets, etc. used in the delivery of the solution.

2.2 [TIER 2 STORAGE SERVICE]

Tier 2 Services - Storage device supporting Medium Performance workloads.

ID	*Primary Attribute*	*Secondary Attribute*	*Specification*
1	Storage Subsystem Hardware (HW)	Workload	Capable to support Medium Performance such as Exchange Server, SQL Server, Virtual servers and generalized web servers with 25,000 or less concurrent users Workload.
		Minimum IO/sec	50,000 SPC-1 IOPS™ as measured by SPC-1 benchmark (http://www.storageperformance.org/results/)
		Minimum Throughput	1,000 SPC-2 MBPS™ as measured by SPC-2 benchmark (http://www.storageperformance.org/results/)
		Storage unit uptime	4'9s uptime.
		Universal Device ID value (UDID)	Changeable LUN UDID value is required.
		Redundancy	Fully redundant power supplies, cooling fans, component controllers, and others. All controllers within a single module will automatically fail over and load balance with one another. Controller module will support a minimum of two controllers.
		FC - Hosts to Storage Connectivity	Storage subsystems must support minimum four 4-Gbit/s Fiber Channel ports. Ability to support ports expansion to meet Tier 1 performance requirements in the same unit(s).
			Minimum two redundant multi-path connections from Host to Storage device. The Host connectivity throughput and performance will not be degraded even if 50% of the Host connectivity is lost.
		iSCSI - Hosts to Storage Connectivity	Storage subsystems must support minimum 1 Gb Ethernet connectivity with link aggregation. 10 Gb Ethernet support is preferred. Controller module will support a minimum of four Ethernet ports. Ability to support ports expansion in the same unit(s). Support Jumbo frame and LACP protocol.
			Minimum two redundant multi-path connections from Host to Storage device. The Host connectivity

ID	*Primary Attribute*	*Secondary Attribute*	*Specification*
			throughput and performance will not be degraded even if 50% of the Host connectivity is lost.
		SCSI Initiator (Host Connections)	Support a minimum of 256
		Replication	Capable of synchronous and asynchronous replication with write order fidelity.
		LUN creation	Ability to create LUN across all spindles.
		LUN Expansion	Dynamic LUN expansion is required.
		Storage provisioning	Capable of over-provisioning or Over-allocation storage capacity that allows hosts to view more storage capacity than has been physically reserved on the storage array itself
		Tiering capability	Using policies to move inactive data to lower tier of storage
		Deduplication	Minimum support post process deduplication.
		Snapshots	Capable of creating point in time delta snapshot Capable of creating space efficient snapshots on an as needed basis versus snapshot space reservation
		Clones	Capable of creating point in time delta clone Capable of creating space efficient clones on an as needed basis versus snapshot space reservation. Immediate access to clones before it is completed.
		Storage device scale up capability	Ability to upgrade controller/controller module on storage device without forklift upgrade.
			Adding or upgrading storage subsystem components adhering to the required storage device uptime requirement and no data migration
		Supported Disk type	Ability to support sufficient disk drive technologies to meet Tier 2 performance requirements.
		Return disk option	Non-return disk option is required
		Interoperability -	Each storage subsystem must provide Storage

ID	Primary Attribute	Secondary Attribute	Specification
		Industry standards	Management Initiative Specification (SMI-S) 1.1 conforming provider (http://www.snia.org/ctp/conformingproviders)
		Firmware and microcode upgrade or updates	Completely non-disruptive to operations firmware and microcode upgrade or updates for all components with zero downtime are required.
		Boot from SAN	Storage subsystem will support boot from San.
		Operating system and file system compatibility	Must support operating systems and their associated file systems as listed in the TRM.
		Applications compatibility (minimum)	Applications listed by VA Technical Reference Model (TRM) for enterprise deployment.
		Redundant Array of Independent Disk (RAID) levels	Minimum support for RAID 0+1/10/5/6 in same subsystems.
		RAID group size	Vendor offering must be able to meet storage capacity without exceeding 7 TB RAID group size and without exceeding 7 data drives.
		Power switches	Master power switches must be covered to prevent inadvertent activation.
		Standardized layouts	Components must be mounted in standardized configurations for all VA installations.
		Additional servers	Refer to Server Standard, Section Class C Server
		Role-based access	Solution must include security configurations that support role-based access required to limit functions during normal and COOP operation.
		Documentation	Provide detail design solution documents and drawings. All design methods and calculations to achieve the performance requirements must be clearly stated in the document. All assumptions if any must be included in the design document
2	Storage Management Software	Enterprise license not based on capacity	Software licenses provided must be perpetual with a five-year support and update subscription, with all licenses and rights transferred to the Government at

ID	Primary Attribute	Secondary Attribute	Specification
			the time the installation is completed. Licenses must be transferable without limitation and provisioned as a VA enterprise license, without additional storage allocation-based charges, such as per GB or TB.
		Interoperability	Management software must be listed as a Storage Networking Industry Association (SNIA) SMI-S 1.1 conforming client. (http://www.snia.org/forums/smi/tech_programs/ctp/smi_conform/smi_client/smi_client_definitions.
		Storage Reporting	Storage reporting components suitable for use in a fee for service, chargeback environment. Automated reports of storage allocations must be capable of being generated by non-IT staff. Must support ODBC and/or JDBC connectivity.
		Automated tools for LUN provisioning	The software should have automated tools to provision a large number of Disk Groups and LUNs. Similarly, an automated solution should be provided to configure hosts with large numbers of logical disks.
		Proactive monitoring and remote notification	The management tool must be capable of proactive monitoring and remote notification of system and application health. Must support ODBC and/or JDBC connectivity.
		Single storage management console	Storage hardware must be manageable from a single storage management application.
		Additional servers	Refer to Server Standard, Section Class C Server
		Management server security	Refer to Server Standard, Section Class C Server
		Data snapshot (local)	License and annual maintenance (5 years) as required for software to support array-based point-in-time data images suitable for use for administrative tasks such as online backup & testing with no impact to source data and minimal additional space requirements.
		Performance analysis	Performance management software to monitor,

ID	Primary Attribute	Secondary Attribute	Specification
			analyze and report on all solution components (i.e. from host to fabric to storage). This includes storage subsystems, software operations, SAN infrastructure, replication and telecommunications. Software should be able to identify and analyze response time, and other relevant metrics to enable identification and resolution of potential bottlenecks. The tool must support OpenVMS client operating system. All management software must be ODBC and/or JDBC connectivity.
		Storage Capacity planning	The software must be able to analyze current capacity and forecasts future system requirements. The software should be able to collect component data to project future usage of the storage system.
		Local copy	License and annual maintenance (5 years) as required for software to support local array-array LUN copy/replication.
		Consistent design	All software should use identical components where possible to facilitate common updates across the solution.
3	Hardware/Software technical support	Support procedures	Documented support/escalation procedure for all components of the solution.
		Support Availability	Software support required 24x7x365 for all software provided in the solution. License and annual maintenance 3 years with 2 extension years.
			Hardware Maintenance/Support 5 yr, 24x7x365, 4 hour response time is required.
		License transfer	Licenses can be transferred without limitation within the Department of Veterans Affairs.
		OEM resources	Direct access to on-line OEM vendor support incident information and tracking.
		Support Interface	All VA datacenters must have access to incident information and tracking for all VA datacenters.
		Disruptive patches	Describe any type of updates/patch that would

ID	*Primary Attribute*	*Secondary Attribute*	*Specification*
			require a hosted service outage of the solution.
		SLAs	Documented Service Level Agreements (SLAs) for support requests.
		Professional services	Include cost of any professional services for services that must be completed by the vendor.
4	Hardware/software Installation	Installation	Provide hardware/software installation, including initial configuration, Storage Area Network configuration & knowledge transfer.
		Pre-configuration	Rack mount and configure the solution (including servers and storage where possible) prior to shipping it to the VA. This minimizes the on-site installation time as well as the number of crates and boxes that must be received and tracked by VA.
		Onsite impact	All on-site activities must be conducted in such a manner as to minimize the impact to normal information systems operations.
		Necessary software/hardware	Provide all necessary hardware and software, including all necessary cables and mounting hardware to make the Solution operational, except government-furnished property (GFP) referenced in GFP section.
		Delivery	Provide inside delivery, installation and insurance of all equipment to VA datacenters. The VA does not accept delivery of the equipment until acceptance testing is passed at all VA datacenters.
		Trash	Remove all trash associated with shipping, delivery and installation.
		OS installation and security	Refer to Server Standard, Section Class C Server
5	Training	Training Length	Provide equivalent of one hour of certified vendor classroom training for every TB of raw disk provided.
		Knowledge transfer	Allow VA staffs to shadow as activities occur to ensure

ID	*Primary Attribute*	*Secondary Attribute*	*Specification*
			that VA can assume operational responsibility for the delivered solution.
		Documentation	Provide electronic copies of all materials, manuals, worksheets, etc. used in the delivery of the solution.

2.3 [TIER 3 STORAGE SERVICE]

Tier 3 Services - Storage device supporting Low and small Performance workloads.

ID	*Primary Attribute*	*Secondary Attribute*	*Specification*
1	Storage Subsystem Hardware (HW)	Workload	Capable to support Small and Low Performance Workload. Target performance would be retrieval of data file of 10 MB within 60 seconds of request.
		Minimum IO/sec	20,000 SPC-1 IOPS™ as measured by SPC-1 benchmark (http://www.storageperformance.org/results/))
		Minimum Throughput	1,000 or less SPC-2 MBPS™ as measured by SPC-2 benchmark (http://www.storageperformance.org/results/)
		Storage unit uptime	4'9s uptime.
		Universal Device ID value (UDID)	Not applicable.
		Redundancy	Fully redundant power supplies, cooling fans, component controllers, and others. All controllers within a single module will automatically fail over and load balance with one another. Controller module will support a minimum of two controllers.
		FC - Hosts to Storage Connectivity	Storage subsystems must support minimum four 4-Gbit/s Fiber Channel ports. Ability to support ports expansion to meet Tier 1 performance requirements in the same unit(s).
			Minimum two redundant multi-path connections from Host to Storage device. The Host connectivity throughput and performance will not be degraded even if 50% of the Host connectivity is lost.
		iSCSI - Hosts to Storage Connectivity	Storage subsystems must support minimum 1 Gb Ethernet connectivity with link aggregation. 10 Gb Ethernet support is preferred. Controller module will support a minimum of four Ethernet ports. Ability to support ports expansion in the same unit(s). Support Jumbo frame and LACP protocol.
			Minimum two redundant multi-path connections from Host to Storage device. The Host connectivity

ID	*Primary Attribute*	*Secondary Attribute*	*Specification*
			throughput and performance will not be degraded even if 50% of the Host connectivity is lost.
		SCSI Initiator (Host Connections)	Support a minimum of 256
		Replication	Capable of synchronous and asynchronous replication with write order fidelity.
		LUN creation	Ability to create LUN across all spindles.
		LUN Expansion	Dynamic LUN expansion is required.
		Storage provisioning	Capable of over-provisioning or Over-allocation storage capacity that allows hosts to view more storage capacity than has been physically reserved on the storage array itself
		Tiering capability	Using policies to move inactive data to lower tier of storage
		Deduplication	Minimum support post process deduplication.
		Snapshots	Capable of creating point in time delta snapshot Capable of creating space efficient snapshots on an as needed basis versus snapshot space reservation
		Clones	Capable of creating point in time delta clone Capable of creating space efficient clones on an as needed basis versus snapshot space reservation. Immediate access to clones before it is completed.
		Storage device scale up capability	Not applicable.
		Supported Disk type	Ability to support sufficient disk drive technologies to meet Tier 3 performance requirements.
		Return disk option	Non-return disk option is required
		Interoperability - Industry standards	Each storage subsystem must provide Storage Management Initiative Specification (SMI-S) 1.1 conforming provider (http://www.snia.org/ctp/conformingproviders)

ID	*Primary Attribute*	*Secondary Attribute*	*Specification*
		Firmware and microcode upgrade or updates	Completely non-disruptive to operations firmware and microcode upgrade or updates for all components with zero downtime are required.
		Boot from SAN	Storage subsystem will support boot from San.
		Operating system and file system compatibility	Must support operating systems and their associated file systems as listed in the TRM.
		Applications compatibility (minimum)	Applications listed by VA Technical Reference Model (TRM) for enterprise deployment.
		Redundant Array of Independent Disk (RAID) levels	Minimum support for RAID 0+1/10/5/6 in same subsystems.
		RAID group size	Vendor offering must be able to meet storage capacity without exceeding 7 TB RAID group size and without exceeding 7 data drives.
		Power switches	Master power switches must be covered to prevent inadvertent activation.
		Standardized layouts	Components must be mounted in standardized configurations for all VA installations.
		Additional servers	Refer to Server Standard, Section Class C Server
		Role-based access	Solution must include security configurations that support role-based access required to limit functions during normal and COOP operation.
		Documentation	Provide detail design solution documents and drawings. All design methods and calculations to achieve the performance requirements must be clearly stated in the document. All assumptions if any must be included in the design document
2	Storage Management Software	Enterprise license not based on capacity	Software licenses provided must be perpetual with a five-year support and update subscription, with all licenses and rights transferred to the Government at the time the installation is completed. Licenses must be transferable without limitation and provisioned as a VA enterprise license, without additional storage

ID	Primary Attribute	Secondary Attribute	Specification
			allocation-based charges, such as per GB or TB.
		Interoperability	Management software must be listed as a Storage Networking Industry Association (SNIA) SMI-S 1.1 conforming client. (http://www.snia.org/forums/smi/tech_programs/ctp/smi_conform/smi_client/smi_client_definitions.
		Storage Reporting	Storage reporting components suitable for use in a fee for service, chargeback environment. Automated reports of storage allocations must be capable of being generated by non-IT staff. Must support ODBC and/or JDBC connectivity.
		Automated tools for LUN provisioning	The software should have automated tools to provision a large number of Disk Groups and LUNs. Similarly, an automated solution should be provided to configure hosts with large numbers of logical disks.
		Proactive monitoring and remote notification	The management tool must be capable of proactive monitoring and remote notification of system and application health. Must support ODBC and/or JDBC connectivity.
		Single storage management console	Storage hardware must be manageable from a single storage management application.
		Additional servers	Refer to Server Standard, Section Class C Server
		Management server security	Refer to Server Standard, Section Class C Server
		Data snapshot (local)	License and annual maintenance (5 years) as required for software to support array-based point-in-time data images suitable for use for administrative tasks such as online backup & testing with no impact to source data and minimal additional space requirements.
		Performance analysis	Performance management software to monitor, analyze and report on all solution components (i.e. from host to fabric to storage). This includes storage subsystems, software operations, SAN infrastructure,

ID	Primary Attribute	Secondary Attribute	Specification
			replication and telecommunications. Software should be able to identify and analyze response time, and other relevant metrics to enable identification and resolution of potential bottlenecks. The tool must support OpenVMS client operating system. All management software must be ODBC and/or JDBC connectivity.
		Storage Capacity planning	The software must be able to analyze current capacity and forecasts future system requirements. The software should be able to collect component data to project future usage of the storage system.
		Local copy	License and annual maintenance (5 years) as required for software to support local array-array LUN copy/replication.
		Consistent design	All software should use identical components where possible to facilitate common updates across the solution.
3	Hardware/Software technical support	Support procedures	Documented support/escalation procedure for all components of the solution.
		Support Availability	Software support required 24x7x365 for all software provided in the solution. License and annual maintenance 3 years with 2 extension years.
			Hardware Maintenance/Support 5 yr, 24x7x365, 4 hour response time is required.
		License transfer	Licenses can be transferred without limitation within the Department of Veterans Affairs.
		OEM resources	Direct access to on-line OEM vendor support incident information and tracking.
		Support Interface	All VA datacenters must have access to incident information and tracking for all VA datacenters.
		Disruptive patches	Describe any type of updates/patch that would require a hosted service outage of the solution.
		SLAs	Documented Service Level Agreements (SLAs) for

ID	*Primary Attribute*	*Secondary Attribute*	*Specification*
			support requests.
		Professional services	Include cost of any professional services for services that must be completed by the vendor.
4	Hardware/software Installation	Installation	Provide hardware/software installation, including initial configuration, Storage Area Network configuration & knowledge transfer.
		Pre-configuration	Rack mount and configure the solution (including servers and storage where possible) prior to shipping it to the VA. This minimizes the on-site installation time as well as the number of crates and boxes that must be received and tracked by VA.
		Onsite impact	All on-site activities must be conducted in such a manner as to minimize the impact to normal information systems operations.
		Necessary software/hardware	Provide all necessary hardware and software, including all necessary cables and mounting hardware to make the Solution operational, except government-furnished property (GFP) referenced in GFP section.
		Delivery	Provide inside delivery, installation and insurance of all equipment to VA datacenters. The VA does not accept delivery of the equipment until acceptance testing is passed at all VA datacenters.
		Trash	Remove all trash associated with shipping, delivery and installation.
		OS installation and security	Refer to Server Standard, Section Class C Server
5	Training	Training Length	Provide equivalent of one hour of certified vendor classroom training for every TB of raw disk provided.
		Knowledge transfer	Allow VA staffs to shadow as activities occur to ensure that VA can assume operational responsibility for the delivered solution.

ID	*Primary Attribute*	*Secondary Attribute*	*Specification*
		Documentation	Provide electronic copies of all materials, manuals, worksheets, etc. used in the delivery of the solution.

2.4 [GENERAL STORAGE AREA NETWORK (SAN)]

Attributes necessary to specify general storage area network fabric for Data Center

ID	*Primary Attribute*	*Secondary Attribute*	*Specification*
1	LAN Connectivity	IP Connectivity between Hosts and Storage device	Minimum 1 Gb Ethernet and 10 Gb Ethernet is preferred. Support Jumbo frame and LACP protocol.
			Support multi-pathing from Hosts and Storage devices.
			Storage Data connection should be logically separate from production LAN data connection.
			Primary storage data connection should be logically separate from replication data connection.
2	Fabric switch hardware (HW)	Fabric Connectivity between Hosts and Storage device	Redundant Switch Control (Supervisor) Card
			Fiber Channel Protocol
			Minimum 4-Gbit/s Fiber Channel Ports
			All fiber Channel switch ports will be autosensing to 1, 2, 4 or 8Gb
		Interoperability	Compatible with equipment from Cisco, Brocade and Nortel hardware.
		Fabric Isolation	Local SAN fabric must be isolated from replication SAN fabric
		Capacity “Throughput”	Isolate data and devices within a fabric, and configurable throughput for specific applications. Supports at least 1 TBps of internal bandwidth in a single chassis (switch enclosure).
		Capacity “Ports”	384 FC ports in a single chassis (switch enclosure). Able to provision additional SAN ports without interruption.
		Port virtualization	Support N Port Virtualization.
		Manageability	Manageable from a single application.
		Fully redundant	Provide fully redundant configuration

ID	Primary Attribute	Secondary Attribute	Specification
		configuration	
		Oversubscription	Provide no more than 4:1 over subscription at 4 Gbps.
		Fabric	SAN switch shall support redundant fabrics.
		Automated monitoring	SAN switches must implement automated monitoring and phone-home support configurations over IP.
		Current generation equipment	Fiber channel switches and/or components must not be listed on vendor websites as “end of life” or “end of sale” or “end of service life”. The initial hardware general availability date should be less than 5 years from the proposal submission date.
		Additional ports	Solution must provision additional SAN ports required to fully connect solution components (storage subsystems, inter-switch links, management hosts, replication hardware, etc) in addition to host requirements.
		Rack Configuration	Provide appropriate 4 posts (42 or 47 U) with sidewalls.
		Manageable power supplies	Redundant IP Manageable & Accessible Power Distribution Unit (PDUs) sufficient to power all units in the rack.
		Cooling	Fans (N+1) on switch and cabinet to support airflow requirements.
		Physical layout	All components must be easily accessible without having to de-install, disconnect or remove other components so that service can be easily accomplished.
		Standardized layouts	Components must be mounted in standardized configurations for all VA installations.
		Additional servers	Refer to Server Standard, Section Class C Server
		Role-based access	Solution must include security configurations that support role-based access required to limit functions

ID	Primary Attribute	Secondary Attribute	Specification
			during normal and COOP operation.
3	SAN Management Software	Management Software	Enterprise level SAN management software Automatic configuration checking for SAN configuration, updates and reconfigurations. Automatic discover of equipment connected to the SAN Manage multiple devices in a selected domain. Wizards for common tasks such as zone configuration, , Fiber Channel over IP (FCIP) tunnels, and access control lists (ACLs) Fabric Interoperability – work with SAN switches regardless of vendor Must support ODBD and JDBC connectivity
		SAN Reporting	SAN reporting components suitable for use in an enterprise environment. Automated reports of storage allocations must be capable of being generated by non-IT staff. Must support ODBC and/or JDBC connectivity.
		Proactive monitoring and remote notification	The management tool must be capable of proactive monitoring and remote notification of system and application health. Must support ODBC and/or JDBC connectivity.
		Performance monitoring	Performance statistics for Inter-Switch Links (ISLs), host and storage device connections, and traffic between specific Fiber Channel sources and destinations (flows) Ability to set performance threshold based on manual entry or calculated based on previous measurements. Historical performance reports and graphs over daily, weekly, monthly, and yearly intervals; Top 10 and daily summary reports for all ISLs, hosts, storage connections, and flows. Performance reports should be accessible without

ID	Primary Attribute	Secondary Attribute	Specification
			privileged access to the SAN switch.
		Single SAN management console	SAN hardware must be manageable from a single storage management application.
		Additional servers	Refer to Server Standard, Section Class C Server
		Management server security	Refer to Server Standard, Section Class C Server
		Consistent design	All software should use identical components where possible to facilitate common updates across the solution.
4	Hardware/Software technical support	Support procedures	Documented support/escalation procedure for all components of the solution.
		Support Availability	Software support required 24x7x365 for all software provided in the solution. License and annual maintenance 3 years with 2 extension years.
			Hardware Maintenance/Support 5 yr, 24x7x365, 4 hour response time is required.
		License transfer	Licenses can be transferred without limitation within the Department of Veterans Affairs.
		OEM resources	Direct access to on-line OEM vendor support incident information and tracking.
		Support Interface	All VA datacenters must have access to incident information and tracking for all VA datacenters.
		Disruptive patches	Describe any type of updates/patch that would require a hosted service outage of the solution.
		SLAs	Documented Service Level Agreements (SLAs) for support requests.
		Professional services	Include cost of any professional services for services that must be completed by the vendor.
5	Hardware/software	Installation	Provide hardware/software installation, including

ID	Primary Attribute	Secondary Attribute	Specification
	Installation		initial configuration, Storage Area Network configuration & knowledge transfer.
		Pre-configuration	Rack mount and configure the solution (including servers and storage where possible) prior to shipping it to the VA. This minimizes the on-site installation time as well as the number of crates and boxes that must be received and tracked by VA.
		Onsite impact	All on-site activities must be conducted in such a manner as to minimize the impact to normal information systems operations.
		Necessary software/hardware	Provide all necessary hardware and software, including all necessary cables and mounting hardware to make the Solution operational, except government-furnished property (GFP) referenced in GFP section.
		Delivery	Provide inside delivery, installation and insurance of all equipment to VA datacenters. The VA does not accept delivery of the equipment until acceptance testing is passed at all VA datacenters.
		Trash	Remove all trash associated with shipping, delivery and installation.
		OS installation and security	Refer to Server Standard, Section Class C Server
		Single-initiator zoning	Hosts shall be connected using single-initiator zoning configuration.
6	Training	Training Length	Provide equivalent of one day of certified vendor classroom training for every 24 fiber channel ports provided.
		Knowledge transfer	Work with VA staff as activities occur to ensure that VA can assume operational responsibility for the delivered solution.
		Documentation	Provide electronic copies of all materials, manuals, worksheets, etc. used in the delivery of the solution.

2.5 [GENERAL BACKUP AND ARCHIVE STANDARD]

Attributes necessary to specify general backup and Archive solution for Data Center

ID	*Primary Attribute*	*Secondary Attribute*	*Specification*
1	Backup Method	Tape	Direct tape backup from Primary storage
			Snapshot from Primary disk to secondary disk and backup to tape. Offload backup resources from primary storage device to secondary storage device (VTL or disk) is preferred
		Disk (Tapeless)	Backup from Primary disk to secondary disk such as Virtual tape library (VTL) with deduplication solution that meets all other backup requirements including retention and offsite storage policy
			Continuous Data Protection (CDP) is preferred for stringent SLA, RPO, and RTO requirements and the ability to recover ANY point in time
			Support Asynchronous replication with deduplicated data is preferred.
		Archive	Long term Data Archiving solution must meet OGC VA Litigation requirements
			Do not access data frequently
2	Virtual tape library (VTL) hardware	Technology	Support Massive Array of Idle Disks (MAID)
		Disk health monitoring	Capable of pro-actively disks monitoring and detecting potential drive failures before it occurs.
		Deduplication	Minimum support post process deduplication.
		Replication	Support Asynchronous replication with deduplicated data
		Raw Storage Capacity	Up to 896 TB per cabinet
		Number of Emulated Tape Libraries	1 to 8

ID	*Primary Attribute*	*Secondary Attribute*	*Specification*
		Number of Emulated Tape Drives	1 to 28 standard (1-512 with HPCM option)
		Number of Virtual Tape Cartridges	Up to 8192
		Connectivity	Minimum four FC connectivity of 4 GigE ports per system
		Redundancy	Redundant fan, N+1 Redundancy, Hot-Swappable Power Supplies
3	Archive Hardware	Technology	Support Massive Array of Idle Disks (MAID)
		Disk health monitoring	Capable of pro-actively disks monitoring and detecting potential drive failures before it occurs.
		Data Storage Architecture	Support write-once-read-many (WORM) and Write Once Read Occasionally (WORO)
		Deduplication	Minimum support post process deduplication.
		Replication	Support Asynchronous replication with deduplicated data
		Protocol Support	CIFS,NFS V2 + V3, TCP/IP
		Number of Files	Up to 1.5 Billion files
		File Size	Up to 1.2TB file size
		Raw Storage Capacity	Up to 896 TB per cabinet
		Number of drives	Single Cabinet Up to 896 drives
		Connectivity	Minimum four FC connectivity of 4 GigE ports per system
		Redundancy	Redundant fan, N+1 Redundancy, Hot-Swappable Power Supplies
4	Tape Library hardware	Interoperability -	Tape Library must provide for tape drives with

ID	Primary Attribute	Secondary Attribute	Specification
		Industry standards	minimum 800 GB uncompressed and throughput minimum of 120 MB/sec. Tape Library drives must be capable of encryption with minimum 1TB tape capacity and throughput minimum of 120 MB/sec. (FIPS 140-2, Level 3)
		Compatibility	Tape library must be capable of reading previously written tapes in the following formats: DLT and LTO.
		Backup SAN	Solution must provision SAN/network components as required to meet performance requirements and isolate backup traffic from normal production traffic.
		Connectivity	Fiber Channel, FICON, ESCON
		Fully redundant configuration	Provide fully redundant configuration such as ports, robots, tape drives, power supplies.
		Current generation equipment	Tape libraries and/or components must not be listed on vendor websites as “end of life” or “end of sale”. The initial hardware general availability date should be less than 5 years from the proposal submission date.
		Library Capacity (throughput)	Minimum throughput of 16 TB per hour
		Capacity (slots)	Solution must provide a minimum of 500 active tape slots
		Scalability (throughput)	Minimum scalability of 20 TB per hour
		Scalability (slots)	Solution must provide the ability to expand to 100% of minimum number of tape slots.
		Rack Configuration	Provide appropriate 4 posts (42 or 47 U) with sidewalls.
		Manageable power supplies	Redundant IP Manageable & Accessible Power Distribution Unit (PDUs) sufficient to power all units in the rack.

ID	*Primary Attribute*	*Secondary Attribute*	*Specification*
		Cooling	N + 1 Fans to support airflow requirements.
		Physical layout	All components must be easily accessible without having to de-install, disconnect or remove other components so that service can be easily accomplished.
		Size	Equipment footprint of less than 60 square feet in fully-scaled configuration.
		Standardized layouts	Components must be mounted in standardized configurations for all VA installations.
		Additional servers	Refer to Server Standard, Section Class C Server.
		Online maintenance	Ability to make hardware changes, repairs and expansion without impacting daily operations.
5	Backup Software/VTL/Archive/ Tape library tool	Backup Software	Provide Enterprise level backup software with ODBC and JDBC connectivity.
			Support Open VMS client and Open VMS Scripting is required
			Software with source and target Deduplication capability. Support Global Deduplication is preferred.
			Capable of synthetic backup
			NDMP backup and restore capable of performing block level backup and file level restore
			Capable of creating snapshots and clones. Support Continuous Data Protection (CDP)
		Tape Library management tool	Provide Enterprise level Tape Library management software. Compatibility with tape backup software. Listed on the VA Technical Reference Model (TRM) is preferred
		Encryption	Enterprise Backup software encryption and Enterprise

ID	Primary Attribute	Secondary Attribute	Specification
			encryption key management system complying with FIPS 140-2 level 3 standards without regard to application, operating system or primary storage device.
		Compatibility	Compatibility with operating systems listed on the VA Technical Reference Model (TRM)
		Scripting	Compatibility with operating systems listed on the VA Technical Reference Model (TRM)
		Proactive monitoring and remote notification	The software and management tool must be capable of proactive monitoring and remote notification of system and application health. Must support ODBC and/or JDBC connectivity.
		Role-based access	Solution must include security configurations that support role-based access required to limit functions during normal and COOP operation.
		Manageability	Manageable from a single application provided as part of the solution.
		Additional servers	Refer to Server Standard, Section Class C Server.
		Management server security	Refer to Server Standard, Section Class C Server.
		Consistent design	All software should use identical components where possible to facilitate common updates across the solution.
6	Hardware/Software technical support	Support procedures	Documented support/escalation procedure for all components of the solution.
		Support Availability	Software support required 24x7x365 for all software provided in the solution. License and annual maintenance 3 years with 2 extension years.
			Hardware Maintenance/Support 5 yr, 24x7x365, 4 hour response time is required.
		License transfer	Licenses can be transferred without limitation within the Department of Veterans Affairs.

ID	*Primary Attribute*	*Secondary Attribute*	*Specification*
		OEM resources	Direct access to on-line OEM vendor support incident information and tracking.
		Support Interface	All VA datacenters must have access to incident information and tracking for all VA datacenters.
		Disruptive patches	Describe any type of updates/patch that would require a hosted service outage of the solution.
		SLAs	Documented Service Level Agreements (SLAs) for support requests.
		Professional services	Include cost of any professional services for services that must be completed by the vendor.
7	Hardware/software Installation	Installation	Provide hardware/software installation, including initial configuration, Storage Area Network configuration & knowledge transfer.
		Pre-configuration	Rack mount and configure the solution (including servers and storage where possible) prior to shipping it to the VA. This minimizes the on-site installation time as well as the number of crates and boxes that must be received and tracked by VA.
		Onsite impact	All on-site activities must be conducted in such a manner as to minimize the impact to normal information systems operations.
		Necessary software/hardware	Provide all necessary hardware and software, including all necessary cables and mounting hardware to make the Solution operational, except government-furnished property (GFP) referenced in GFP section.
		Delivery	Provide inside delivery, installation and insurance of all equipment to VA datacenters. The VA does not accept delivery of the equipment until acceptance testing is passed at all VA datacenters.
		Trash	Remove all trash associated with shipping, delivery and installation.

ID	*Primary Attribute*	*Secondary Attribute*	*Specification*
		OS installation and security	Refer to Server Standard, Section Class C Server.
8	Training	Training Length	Provide equivalent of one day of certified vendor classroom training for every installed tape drive or every 12TB of VTL and Archive storage space.
		Knowledge transfer	Work with VA staff as activities occur to ensure that VA can assume operational responsibility for the delivered solution.
		Documentation	Provide electronic copies of all materials, manuals, worksheets, etc. used in the delivery of the solution.

3 SUPPORTING DETAILS FOR STANDARDS

3.1 [TIER 1 STORAGE SERVICE]

3.1.1 [STORAGE SUBSYSTEM HARDWARE (HW)]

STANDARD

ID	*Secondary Attribute*	*Specification*
	Workload	Capable to support Extreme High and High Workload such as OLTP databases (Cache/IDMS/Oracle/SQL) with 25,000 or more concurrent users
	Minimum IO/sec	100,000 SPC-1 IOPS™ as measured by SPC-1 benchmark (http://www.storageperformance.org/results/)
	Minimum Throughput	5,000 SPC-2 MBPS™ as measured by SPC-2 benchmark (http://www.storageperformance.org/results/)
	Storage unit uptime	5'9s uptime.
	Universal Device ID value (UDID)	Changeable LUN UDID value is required.
	Redundancy	Fully redundant power supplies, cooling fans, component controllers, and others. All controllers within a single module will automatically fail over and load balance with one another. Controller module will support a minimum of two controllers.
	FC - Hosts to Storage Connectivity	Storage subsystems must support minimum four 4-Gbit/s Fiber Channel ports. Ability to support ports expansion to meet Tier 1 performance requirements in the same unit(s).
		Minimum two redundant multi-path connections from Host to Storage device. The Host connectivity throughput and performance will not be degraded even if 50% of the Host connectivity is lost.
	iSCSI - Hosts to Storage Connectivity	Storage subsystems must support minimum 1 Gb Ethernet connectivity with link aggregation. 10 Gb Ethernet support is preferred. Controller module will support a minimum of four Ethernet ports. Ability to support ports expansion in the same unit(s). Support Jumbo frame and LACP protocol.
		Minimum two redundant multi-path connections from Host to Storage device. The Host connectivity throughput and performance will not be degraded even if 50% of the Host connectivity is lost.

	FICON connectivity	Storage subsystems must support FICON connectivity
	SCSI Initiator (Host Connections)	Support a minimum of 256
	Replication	Capable of synchronous and asynchronous replication with write order fidelity.
	LUN creation	Ability to create LUN across all spindles.
	LUN Expansion	Dynamic LUN expansion is required.
	Storage provisioning	Capable of over-provisioning or Over-allocation storage capacity that allows hosts to view more storage capacity than has been physically reserved on the storage array itself
	Tiering capability	Using policies to move inactive data to lower tier of storage
	Resource partitioning capability	Capable of isolating subsystem resources (such as Cache, Ports, CPU and Disk) and dedicate to particular host.
	Dynamically tuning	Dynamically tune and optimize storage subsystem components such as cache memory, disk, I/O ports in a single storage system is required.
	Backend Storage virtualization	Capable to connect other backend storage devices
	Snapshots	Capable of creating point in time delta snapshot Capable of creating space efficient snapshots on an as needed basis versus snapshot space reservation
	Clones	Capable of creating point in time delta clone Capable of creating space efficient clones on an as needed basis versus snapshot space reservation. Immediate access to clones before it is completed.
	Storage device scale up capability	Ability to upgrade controller/controller module on storage device without forklift upgrade.
		Adding or upgrading storage subsystem components adhering to the required storage device uptime requirement and no data migration
	Supported Disk type	Ability to support sufficient disk drive technologies to meet Tier 1 performance requirements.
	Return disk option	Non-return disk option is required

	Interoperability - Industry standards	Each storage subsystem must provide Storage Management Initiative Specification (SMI-S) 1.1 conforming provider (http://www.snia.org/ctp/conformingproviders)
	Firmware and microcode upgrade or updates	Completely non-disruptive to operations firmware and microcode upgrade or updates for all components with zero downtime are required.
	Boot from SAN	Storage subsystem will support boot from San.
	Operating system and file system compatibility	Must support operating systems and their associated file systems as listed in the TRM.
	Applications compatibility (minimum)	Applications listed by VA Technical Reference Model (TRM) for enterprise deployment.
	Redundant Array of Independent Disk (RAID) levels	Minimum support for RAID 0+1/10/5/6 in same subsystems.
	RAID group size	Vendor offering must be able to meet storage capacity without exceeding 7 TB RAID group size and without exceeding 7 data drives.
	Power switches	Master power switches must be covered to prevent inadvertent activation.
	Standardized layouts	Components must be mounted in standardized configurations for all VA installations.
	Additional servers	Refer to Server Standard, Section Class C Server
	Role-based access	Solution must include security configurations that support role-based access required to limit functions during normal and COOP operation.
	Documentation	Provide detail design solution documents and drawings. All design methods and calculations to achieve the performance requirements must be clearly stated in the document. All assumptions if any must be included in the design document

EXPLANATION OF STANDARD

Workload – The storage system must be able to handle the amount of data and transactions that accompany large shared enterprise level applications with high amounts of transactions and large amounts of I/O. Capable of supporting Extreme High and High performance workloads such as OLTP databases (Cache/IDMS/Oracle/SQL) with

25,000 or more concurrent user, time-sensitive batch jobs with financial penalties for late completion and some virtualized platforms.

Minimum IO/sec - The SPC-1 minimum benchmark as identified in this standard provides for a independent and objective measuring tool with regards to IOPS (Input/Output operations per second) for which all potential SAN Solutions can be gauged. Specific test include OLTP, database operations and mail server implementations. Specifically SPC-1 is defined by www.storageperformance.com as "a single workload designed to demonstrate the performance of a storage subsystem while performing the typical functions of business critical applications. Those applications are characterized by predominately random I/O operations and require both queries as well as update operations". **The specific benchmark value was determined based on analysis of major vendor SPC benchmark submissions.**

Minimum Throughput - The SPC-2 minimum benchmark as identified in this standard provides for an independent and objective measuring tool with regards to MBPS (megabits per second) transfer rates for which all potential SAN Solutions can be gauged. Specific tests include large file processing, large database queries and video on demand (VOD). Specifically SPC-2 is defined by www.storageperformance.com as "three distinct workloads designed to demonstrate the performance of a storage subsystem during the execution of business critical applications that require the large-scale, sequential movement of data. Those applications are characterized predominately by large I/Os organized into one or more concurrent sequential patterns. A description of each of the three SPC-2 workloads is listed below as well as examples of applications characterized by each workload". **The specific benchmark value was determined based on analysis of major vendor SPC benchmark submissions.**

Storage unit uptime- In normal operation, the subsystem should not require more than five minutes interruption in a year for software upgrade or component replacement. Uptime is all connected hosts able to continue processing data. Additional Information can be gathered at http://www.uptimeinstitute.org.

Universal Device ID value (UDID) – In OpenVMS hosts must have a unique unit device identifier (UDID) for each accessible disk volume. To enable this, the subsystem must enable control over UDID assignment so that different disk arrays will not present the same UDID to the OpenVMS host.

Redundancy – Failure of a single component will not stop storage system operation in any capacity. Fully redundant storage systems are critical to the continuing processing and to maintain system stability.

FC – Host to Storage Connectivity – Storage subsystem must have multiple 4 Gb/second connectivity. An 8/GB connection is highly desirable.

iSCSI – Hosts to Storage Connectivity - For interoperability the SAN Solution that is procured must provide current iSCSI capabilities of 1GB current connectivity and the ability to upgrade to future higher speed connectivity. Additionally, Link Aggregation with dual NICS support is required.

SCSI Initiators (host connections) – a SCSI initiator is the host-side endpoint of a SCSI session. Every redundant host connection requires two SCSI initiators.

Replication – Replication is typically a software function, but hardware must support replication

LUN creation – The ability to create LUN's 'on the fly' without outage to the system and without disruption to the host systems.

LUN Expansion – Ability to add space to a LUN without rewriting data on that LUN.

Storage provisioning – Commonly called “thin provisioning”. Thin provisioning is typically a software function, but hardware must support it.

Tiering capability - Manually or automatic policies to move inactive data to lower tier of storage, either in same or other frame. Tiering is typically a software function, but hardware must support it.

Resource partitioning capability – The ability to dedicate cache, ports or other subsystem resources to groups of LUNs or hosts.

Dynamic Tuning - The ability to create or update cache, ports or other subsystem resources to groups of LUNs or hosts while the system is serving I/O requests.

Backend Storage Virtualization – As the storage system will potentially be one of many with a heterogeneous data canter the capable to connect other backend storage devices from various storage vendors.

Snapshots – Snapshots are typically a software function, but hardware must support data snapshots (copy on write)

Clones – LUN cloning is typically a software function, but hardware must support data clone (full copies)

Storage device scale up capability – Upgrade controllers, cache or drives within same cabinets/footprint. Add controllers, cache, cabinets or drives without interrupting service or data migration.

Supported Disk type - As a minimum the SAN solution will provide the ability to utilize and support Fiber Channel drives, SATA drives and any near horizon drive technology (i.e. Solid State Drives) within the same SAN system.

Return disk option - As part of the support contract any failed disk within the SAN device or accompanying management servers will not be returned to the vendor. They will be maintained, secured and destroyed in accordance with applicable VA regulations with regards to data destruction.

Interoperability - Industry standards - for consistency and to ensure that the SAN Solution provided meets the criteria set forth by both Industry Standards and the VA Standard a baseline of specifications are needed. These specifications are best indicated by the Storage Management Initiative Specification (SMI-S) which was developed by leading storage equipment and software providers.

Firmware and microcode upgrade or updates - The capabilities to perform firmware and microcode updates without interrupt to the operations of the SAN and hosts devices connected there to. This is to include, but not limited to, disk firmware, controller firmware, controller software, and internal SAN Fabric switches.

SAN boot support (minimum) - The ability to provide the operating system of a host server to boot directly from the SAN device without local server disks is required. Please see the Operating Systems as listed in VA Technical Reference Model.

Operating system compatibility (minimum) - Please see the Operating Systems as listed in VA Technical Reference Model (TRM). The current VA TRM will be provided by COTR during acquisition process

Applications compatibility (minimum) - Please see the Applications as listed in VA Technical Reference Model. The current VA TRM will be provided by COTR during acquisition process.

Redundant Array of Independent Disk (RAID) levels - Due to the varying needs and uses the SAN Solution will be required to support the capabilities of RAID1, RAID5 and RAID6 in the same storage subsystems and disk enclosure. While above is a minimum RAID levels additional RAID configuration support is desired.

RAID group size - The size limit for a RAID group must not exceed 7TB in order to obtain optimal performance. The size requirement for a RAID group is based on the ability to rebuild the RAID group following a disk failure. Based on a drive MTTF of 1,000,000 hours, a RAID-5 group larger than 7 TB has a high risk of not being able to successfully rebuild without an unrecoverable error (URE). The existence of 7 drives to a RAID set is optimal and is the recommend amount to be allocated to any given RAID drive set.

Power switches - In addition to being redundant all power switches and power plugs must be properly secured and encased to ensure that they cannot be accidentally tripped, unseated or create any situation where power will be disrupted to the devices they are providing power to.

Standardized layouts - The layout of the solution must be a consistent design that is in use at all datacenters that are keeping with VA standards. This approach allows for the redistribution of the equipment to different sites and the most efficient use of data center space.

Additional servers - SAN support is often managed via a dedicated server(s). These hosts must be supported by the same support contract and remote management. Additionally all host must adhere to all the VA security policies and procedures with relation to servers, must be FIPS140-2 compliant and have only VA approved software installed.

Role-based Access - The ability for the applicable support personnel to manage the SAN solution and support servers from an industry standard out of band management solution is required and critical. Due to the remote nature and decentralized nature of support personnel must be able to access the SAN and servers even while shutdown or during BIOS/POST operations.

Documentation - Documentation must be provided that is described in the standard that allows for the complete understanding of the solution that is implemented. The importance of this is to create a seamless handoff from the varying organizations that will be supporting the SAN solution.

EVALUATION FACTORS

Lowest Total Cost of Ownership (TCO) solution that meets the performance requirements is preferred. Components considered are small footprint, power consumption, cooling, Hardware, Software, license, Overhead cost of managing the devices, Ease of Management, Acquisition cost, Maintenance and deployment costs, storage capacity (such as number of data copies),Information Lifecycle Management(ILM) cost.

Workload – The use of industry standard tools and benchmarks to provide adequate levels of validation during the acquisition process is critical to ensure the system procured can handle the rigors and high demands set forth in this tier.

Minimum IO/sec - The threshold of 100,000 IOPS using this SPC-1 benchmark has been identified as the minimum to provide the needs of the VistA application.

Minimum Throughput -The threshold of 5,000MBPS using this SPC-2 benchmark has been identified as the minimum to provide the needs of the VistA application.

Storage unit uptime – REQUIRED as defined in the standard above for this Tier. This would be 5 nines which equates to 5.26 minutes per year.

Universal Device ID value (UDID) - Required **in** order to support all the Operating Systems that may utilize the procured storage subsystem.

Redundancy – REQUIRED Redundant components are needed to ensure the failure of one component of the storage system will not cause an outage.

FC – Hosts to Storage Connectivity – REQUIRED **4**/GB connections however 8/GB connections are highly desirable and requested.

iSCSI – Hosts to Storage Connectivity – REQUIRED with minimum current iSCSI capabilities of 1GB connectivity with 10GB preferred and or expandable to in future.

SCSI Initiators (host connections) – a SCSI initiator is the host-side endpoint of a SCSI session. Every redundant host connection requires two SCSI initiators. The greater the available space to be assigned (usable) the more initiators would be required. Suggest at least one SCSI initiator for every two drive slots or 256 minimum.

Replication – Storage subsystem must support asynchronous and synchronous HA and DR replication

LUN Creation – LUN creation is a must in the type of environment that this tiered solution will be placed.

LUN Expansion – REQUIRED

Storage provisioning – Function included in cost. Thin provisioning is typically a software function, but hardware must support it.

Tiering capability – Function included in cost. Thin provisioning is typically a software function, but hardware must support it. Array needs to support or include multiple drive types or if tiering will be between multiple storage subsystems of heterogeneous types.

Resource partitioning capability and **Dynamic Tuning –** These two items must work together to allow for the dedication and allocation of resources to critical host or processes at a given time or event. Whether these are done manually or automatically by the storage system is a function of one or both of these specifications.

Backend Storage Virtualization – Determination will need to be made as to the vendor, type and specific storage system that the storage system being evaluated will connect, communicate and function with.

Snapshots – Compare limits on number of snapshots that can be made of a primary storage LUN

Clones – Compare limits on number of snapshots that can be made of a primary storage LUN

Storage device scale up capability – REQUIRED Evaluate based on expandability of usable storage in TB

Supported Disk type - REQUIRED the supported disk type must be specified in all documentation as to the exact type, speed and capacity.

Return disk option - REQUIRED To be documented in the procurement that no failed disks will be returned to vendor or leave in the possession of the VA at all times until properly disposed.

Interoperability – Industry standards – REQUIRED the supporting documentation should be presented and validated during the acquisition process. These specifications are SMI-S v1.1 as described at: http://www.snia.org/forums/smi/tech_programs/smis_home/

Firmware and microcode upgrade or updates – REQUIRED the means at which the vendor's solution will accomplish this task needs to be documented and tested prior to acceptance of the solutions.

SAN boot support (minimum) - REQUIRED to support the operating systems listed are required within this document

Operating system compatibility (minimum) – At a minimum the supported solution will provide OS support for Windows based Operating System, Linux Based Operating System, UNIX based Operating System and OpenVMS Operating System. The current VA TRM will be provided by COTR during acquisition process.

Applications compatibility (minimum) – The current VA TRM will be provided by COTR during acquisition process.

Redundant Array of Independent Disk (RAID) levels should meet the current and future needs of the VA. While the current VistA "Production data" resides on mirrored RAID1 drives the ability to augment them with addition RAID types is important. Raid group sizing limitations of Terabytes and number of physical drives is needed and should be evaluated as part of the acquisition process.

RAID group size - The size limit for a RAID group must not exceed 7TB in order to obtain optimal performance. The total number of drives assigned to a particular RAID set must not exceed seven physical drives. This is to ensure the integrity of the RAID group.

Power switches - All power switches and power plugs must be properly secured and encased

Standardized layouts - Layout and plan design will need to be validated during the acquisition process

Additional servers - All additional servers should be identified during the procurement process and keep with the VA Server Standards.

Role-based Access - Refer to Server Standard, Section Class C Server

Documentation - Cost of documentation should be identified and included in the procurement process. Vendor shall provide electronic, three dimensional models of equipment proposed for use with CAD and visual design/planning applications.

IMPLEMENTATION GUIDANCE

Lowest Total Cost of Ownership (TCO) solution that meets the performance requirements is preferred.

Workload- The use of industry standard tools and benchmarks to provide adequate verifications levels during acceptance testing. Extreme workloads are typically not the entire data hosted by a particular server. For example, in the case of databases, logs and indexes typically require more performance than other data. Data may be more efficiently hosted on multiple platforms.

Minimum IO/sec – Include validation in acceptance testing

Minimum Throughput – Include validation in acceptance testing

Storage Unit Uptime – Include validation in acceptance testing

Universal Device ID value (UDID) – Include validation in acceptance testing

Redundancy – Include validation in acceptance testing**.** Component failure testing should occur prior to putting into production. This should include a planned failure of a single component to ensure the backup/ secondary component provides adequate coverage to verify no outage of the storage system.

FC - Hosts to Storage Connectivity – Recommend 8/GB Fibre Channel connections to host.

iSCSI - Hosts to Storage Connectivity – Include validation in acceptance testing

iSCSI Initiator (Host Connections) - Include validation in acceptance testing

Replication – Testing of the replication process should occur during acceptance testing.

LUN Creation - Testing and actual creation for production should occur during acceptance testing to provide validation.

LUN Expansion – Include validation in acceptance testing

Storage Provisioning – Include validation in acceptance testing

Tiering Capability – If software is in place and capabilities exist the testing of this function should be conducted from this tier to a lower (or higher) tier.

Resource partitioning capability – The testing and validation of isolating subsystem components to specific hosts and process are measured and the findings documented and verified.

Dynamic Tuning – Stress testing and high usage simulation is done to validate. Dynamic Tuning should work very closely with Resource partitioning capability requirement to provide adequate resources to meet the needs of the processes and hosts at any given time.

Backend Storage Virtualization – Connection too and testing of the interoperability of the system being implemented to that of existing systems must be conducted and validated.

Snapshots – Include validation in acceptance testing

Clones – Include validation in acceptance testing

Supported Disk type - Fibre Channel and iSCSI are needed at a minimum.

Return disk option - Not applicable other than being aware of if any disk failure during implementation.

Interoperability – Industry standards - The standards which are provided in the sections above must be adhered to and validated during the implementation phase using the common set of tools identified in the SMI-S v1.1.

Firmware and microcode upgrade or updates - The means this is achieved by the SAN Solution needs to be tested.

SAN boot support (minimum) – Test and implement during installation with validation in acceptance testing

Operating system compatibility (minimum) - Include validation in acceptance testing

Applications compatibility (minimum) - Include validation in acceptance testing

Redundant Array of Independent Disk (RAID) levels - Include validation in acceptance testing

RAID group size - Include validation in acceptance testing

Power switches - All power switches and power plugs must be properly secured and encased. This also includes the proper covering of any emergency cutoff switches.

Standardized layouts - Ensure that all layouts conform to VA Standard and are validated during installation.

Additional servers - Operating System and Applications must be VA Server Standard. The current VA TRM will be provided by COTR during acquisition process. Refer to Server Standard, Section Class C Server

Role-Based Access – Described and documented in the support contract.

Documentation - All documentation should be in the form in a standard form that can be used by all VA support staff (i.e. Word documents, pdf or Visio).

3.1.2 [MAINFRAME SUPPORT]

STANDARD

ID	*Secondary Attribute*	*Specification*
	Parallel Access Volume (PAV)	Ability to support/exploit Parallel Access Volume (PAV).
	FICON support	Minimum 8-Gbit/s FICON Channel ports. Ability to support additional ports in the same enclosure
	HiperPAV support	Ability to support HiperPAV. Dynamic capabilities associated with Parallel Access Volumes.
	SMF support	Support SMF – Must have compatibility with this activity log recording feature
	Emulation types	Must be able to emulate 3390 based count key data devices.
	Solid State devices (SSD) support on Mainframe	Must be able to support solid state devices on Mainframe. Tools are needed to analyze mainframe data for SSD exploitation.
	Dynamic Channel Reconfiguration support	Must be able to support Dynamic Channel Reconfiguration.
	MIDAW support	Must be able to support MIDAW facility
	Priority I/O Queuing	Must be able to support Priority I/O Queuing

EXPLANATION OF STANDARD

EVALUATION FACTORS

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IMPLEMENTATION GUIDANCE

3.1.3 [STORAGE MANAGEMENT SOFTWARE]

STANDARD

ID	*Secondary Attribute*	*Specification*
	Enterprise license not based on capacity	Software licenses provided must be perpetual with a five-year support and update subscription, with all licenses and rights transferred to the Government at the time the installation is completed. Licenses must be transferable without limitation and provisioned as a VA enterprise license, without additional storage allocation-based charges, such as per GB or TB.
	Interoperability	Management software must be listed as a Storage Networking Industry Association (SNIA) SMI-S 1.1 conforming client. (http://www.snia.org/forums/smi/tech_programs/ctp/smi_conform/smi_client/smi_client_definitions.
	Storage Reporting	Storage reporting components suitable for use in a fee for service, chargeback environment. Automated reports of storage allocations must be capable of being generated by non-IT staff. Must support ODBC and/or JDBC connectivity.
	Automated tools for LUN provisioning	The software should have automated tools to provision a large number of Disk Groups and LUNs. Similarly, an automated solution should be provided to configure hosts with large numbers of logical disks.
	Proactive monitoring and remote notification	The management tool must be capable of proactive monitoring and remote notification of system and application health. Must support ODBC and/or JDBC connectivity.
	Single storage management console	Storage hardware must be manageable from a single storage management application and with the capability of automatic discovery of equipment connected to the SAN.
	Additional servers	Refer to Server Standard, Section Class C Server
	Management server security	Refer to Server Standard, Section Class C Server
	Data snapshot (local)	License and annual maintenance (5 years) as required for software to support array-based point-in-time data images suitable for use for administrative tasks such as online backup & testing with no impact to source data and minimal additional space requirements.

	Performance analysis	Performance management software to monitor, analyze and report on all solution components (i.e. from host to fabric to storage). This includes storage subsystems, software operations, SAN infrastructure, replication and telecommunications. Software should be able to identify and analyze response time, and other relevant metrics to enable identification and resolution of potential bottlenecks. The tool must support OpenVMS client operating system. All management software must be ODBC and/or JDBC connectivity.
	Storage Capacity planning	The software must be able to analyze current capacity and forecasts future system requirements. The software should be able to collect component data to project future usage of the storage system.
	Local copy	License and annual maintenance (5 years) as required for software to support local array-array LUN copy/replication.
	Consistent design	All software should use identical components where possible to facilitate common updates across the solution.

EXPLANATION OF STANDARD

Enterprise license not based on capacity – to include 5 years of support as required for enterprise SAN Management application. Licenses must be transferable without limitation and provisioned as a VA enterprise license, without additional storage allocation-based charges, such as per GB or TB.

Interoperability - Management software must be listed as a Storage Networking Industry Association (SNIA) SMI-S 1.1 conforming client.
(http://www.snia.org/forums/smi/tech_programs/ctp/smi_conform/smi_client/smi_client_definitions

Storage Reporting – Access level reporting with the ability to generate reports by non-IT staff.

Automated tools for LUN provisioning - a single, intelligent interface that allows you to provision storage systems and fabric switches from end-to-end. The software should have automated tools to provision a large number of Disk Groups and LUNs along with the ability to configure hosts with large numbers of logical disks.

Proactive monitoring and remote notification - Storage Management software must be capable of monitoring and remote notification in the event of an alert, failure or the inability of the system to meet the customer's SLA's. Provisioning actions to trigger events, SNMP traps, and policies for notification. Ability to send email or custom scripts or programs for notification.

Single Storage Management console – Storage hardware must be manageable from a single storage management application.

Data snapshot (local) - License and annual maintenance (5 years) as required for software to support array-based point-in-time data images suitable for use for administrative tasks such as online backup & testing with no impact to source data and minimal additional space requirements.

Performance analysis – Storage management software to monitor, analyze and report on all solution components (i.e. from host to fabric to storage). This includes storage subsystems, software operations, SAN infrastructure, replication and telecommunications. Software should be able to identify and analyze response time, and other relevant metrics to enable identification and resolution of potential bottlenecks.

Storage Capacity planning - The software must be able to analyze current capacity and forecasts future system requirements. The software should be able to collect component data to project future usage of the storage system.

Local copy - License and annual maintenance (5 years) as required for software to support local array-array LUN copy/replication.

Consistent Design – All software should use identical components where possible to facilitate common updates across the solution.

EVALUATION FACTORS

- Enterprise Level Storage Management software
- Ability to manage multiple devices
- Enterprise License w/5years annual maintenance
- Storage Management Reporting
- Performance Monitoring
- Single Storage management console
- Ability to Manage events and policies

IMPLEMENTATION GUIDANCE

Implementation should include all optional software needed to meet the requirements listed above. Licensing and maintenance terms should the Hardware/Software Technical Support sections of this document. Professional implementation services should be included along with “classroom” training for support staff as outlined in the Training sections of this document.

3.1.4 [HARDWARE/SOFTWARE TECHNICAL SUPPORT]

STANDARD

ID	*Secondary Attribute*	*Specification*
	Support procedures	Documented support/escalation procedure for all components of the solution.
	Support Availability	Software support required 24x7x365 for all software provided in the solution. License and annual maintenance 3 years with 2 extension years.
		Hardware Maintenance/Support 5 yr, 24x7x365. For issue impacting production operation, Tier2 or greater phone support response should be available within the first hour and less than 4 hours response for Engineer to bring parts onsite.
	License transfer	Licenses can be transferred without limitation within the Department of Veterans Affairs.
	OEM resources	Direct access to on-line OEM vendor support incident information and tracking.
	Support Interface	All VA datacenters must have access to incident information and tracking for all VA datacenters.
	Disruptive patches	Describe any type of updates/patch that would require a hosted service outage of the solution.
	SLAs	Documented Service Level Agreements (SLAs) for support requests.
	Professional services	Include cost of any professional services for services that must be completed by the vendor.

EXPLANATION OF STANDARD

Support procedures – A documented (digital & printed) set of instructions and escalation procedures to include updated contact information for the appropriate point of contact while troubleshooting problems. This will be a living document and as such digital copies should have supplements/replacements provided quarterly to ensure the most up to date procedures are available for the customer.

A concisely documented set of procedures is essential for communication between the customer and the support staff, allowing for all parties to know when priority escalation occurs, how it occurs, and the proper path for the expedited resolution.

Support Availability – Due to the criticality of these systems, full round the clock support is essential for a minimum of the first year, with options available to extend for the following four years allowing for a total of five years. For issue impacting production operation, Tier2 or greater phone support response should be available within the first hour and less than 4 hours response for Engineer to bring parts onsite.

License transfer – All pertinent licenses must be capable of being transferred between various VA sites and cannot be restricted by location. Due to the nature of the OI&T structure for the VA licenses must be capable of being transferred within the various physical locations without restriction.

OEM resources – Direct communication paths to the knowledge experts of a product is key for fast response and ensuring the systems remain operational at the levels needed. Being required to go through middlemen in efforts to funnel trouble calls is not suitable to the nature of these systems.

Speaking directly with the product expert allows for potential miscommunication errors to be avoided. Being able to go directly to the appropriate level of tier knowledge on a failure is essential for ensuring that the problem is communicated correctly and quickly the best support engineer that can assist the customer.

Support interface – Due to many VA experts working across various regions and areas it is vital for all site's to be able to access VA wide information for troubleshooting and sharing of information.

VA I.T. support is organized through a central Office of Information Technology and is required to assist each various region/area as needed. Support contact and information should not be limited to a locality and must allow for access across the VA areas.

Disruptive patches – Ideally updates/patches will be able to be implemented with 0% system downtime. Any operations that would require a system outage needs to be documented and provided for review.

VA standards require that all disruptions be documented, submitted, and tracked to resolution. Known procedures that require disruption of service need to be documented and said documentation made available. Support engineers will need to work with VA staff to ensure that the required procedures for disruptions are followed.

SLAs - Documented Service Line Agreements (SLAs) for support request will be provided and the Vendor will ensure that there is no confusion between VA staff and Vendor on expectations.

Professional services – Provide a full disclosure of vendor specific services that must be provided by the vendor only. I.E. Some storage systems require a vendor engineer to flash firmware or similar upgrades and do not allow the customer to perform such actions.

VA standards require that outside contractors be escorted and/or evaluated for security requirements. All expected procedures that require vendor services need to be provided and a list of potential engineers that will be onsite updated as needed to ensure the engineer can gain access.

EVALUATION FACTORS

- Quality of documentation to include ease of finding information, extent of informative data, and usability in regards to trouble shooting and technical support will be considered.
- Direct phone contact for immediate escalation of troubleshooting over email, web interface, or other "automated" trouble shooting requests will be preferred.
- While direct access to product experts are needed, having a support engineer/contact to supervise and ensure that all experts are moving forward with the end goal of problem expedient problem resolution is preferred.
- Central/Single Interface for multiple sites to track VA related problems will be preferred.
- Minimum amount of scheduled downtime for patching/updating and supporting evidence for such is preferred.
- Path of communication for VA to suggest improvements and see improvements implemented is beneficial.
- Forums or other user group discussion areas are beneficial.
- Lower on-site response time is beneficial.
- Lower initial "engineer level" contact response time is beneficial.
- Lower time-to-repair is beneficial.
- Vendor-supplied components stocked as spares near, or at, facility is beneficial.
- Penalty clauses for vendor not meeting support contract provides is beneficial.

IMPLEMENTATION GUIDANCE

Coordination with initial VA staff for knowledge transfer and verified understanding is important. Continuing contact with VA staff to ensure support procedures are viable and procedures in place for VA input to improve support/product is essential.

3.1.5 [HARDWARE/SOFTWARE INSTALLATION]

STANDARD

ID	*Secondary Attribute*	*Specification*
	Installation	Provide hardware/software installation, including initial configuration, Storage Area Network configuration & knowledge transfer.
	Pre-configuration	Rack mount and configure the solution (including servers and storage where possible) prior to shipping it to the VA. This minimizes the on-site installation time as well as the number of crates and boxes that must be received and tracked by VA.
	Onsite impact	All on-site activities must be conducted in such a manner as to minimize the impact to normal information systems operations.
	Necessary software/hardware	Provide all necessary hardware and software, including all necessary cables and mounting hardware to make the Solution operational, except government-furnished property (GFP) referenced in GFP section.
	Delivery	Provide inside delivery, installation and insurance of all equipment to VA datacenters. The VA does not accept delivery of the equipment until acceptance testing is passed at all VA datacenters.
	Trash	Remove all trash associated with shipping, delivery and installation.
	OS installation and security	Refer to Server Standard, Section Class C Server

EXPLANATION OF STANDARD

Installation - Provide planning, configuration and tentative schedule for the initial installation. This planning should involve collaborating with customer technical personnel to insure any and all critical elements and requirements regarding the environment are communicated. This process is envisioned as a collaborative effort between the vendor and customer with the end result being an installation that is 100 percent complete, functional and fully documented and the customer understanding everything needed to operate and maintain the system. This also includes demonstrating the steps necessary to backup and restore the system to a fully functional state. This entire process is to be conducted in such a manner as to minimize the impact to normal information systems operation.

Pre-configuration - To shorten the installation process and better utilize the time vendor personnel are on-site it is required pre-racking and pre-configuring the solution as much as possible prior to delivery. This includes working with customer personnel to develop any custom software images and preload the images prior to shipping.

Restorable images – In addition to having hardware preloaded with software a process must be in place to have restorable images for these systems as a backup to needing to overwrite/restore an existing image during install. Custom DVD's, portable storage, etc… are all viable options to having the image onsite for quick access and use.

Onsite impact – Minimal impact on the site facility is required. Efforts will be taken by the Vendor to ensure that the prep, assembly, install, and testing of the Solution will be done in a professional manner with minimal impact upon local site. Concern in regards to trash, path blockage, unsecured equipment, excessive levels of noise, etc… should be considered and action taken accordingly.

Necessary software/hardware – Aside from government-furnished property (GFP) referenced in the GFP section, all software and hardware required to make the Solution operational will be provided by the Vendor. This is to include but not limited to: cables, mounting brackets, screws, install software, testing equipment, etc…

Delivery – The Vendor will take responsibility of ensuring that all materials are delivered into the facility install location and the materials will remain the responsibility of the Vendor until acceptance testing is passed at all VA datacenters.

Trash – The Vendor will take responsibility of the removal of all trash from the facility, including but not limited to: boxes, packing materials, plastic bags, ties, etc…

OS installation and security – Following existing documentation provide by the VA Platform Server Team ensure all Operating systems and Security applications are installed accordingly.

EVALUATION FACTORS

- It is considered beneficial if the vendor can detail a delivery, installation and configuration plan for the equipment the vendor is proposing.
- Any demonstration that equipment can be pre-racked, pre-configured or pre-imaged is considered beneficial
- Verification that images can be restored onsite instead of remotely for install purposes is preferred.
- A basic plan to show minimal impact during installation and setup with certified technicians to follow this plan is preferred. Vendor hiring lowest cost "IT Talent" is not preferred.
- Checklists of hardware and software installation needs and verified availability of these is beneficial.

IMPLEMENTATION GUIDANCE

As much Vendor/VA staff preinstall communication to ensure full understanding is recommended.

Vendor verification of hardware fitting and requirements prior to install is required. Finding out at install that a piece of equipment does not fit or does not have all the install equipment is not acceptable.

All documentation, software, and hardware required for installation and operation of the Solution as well as training materials need to be onsite and verified for installation.

3.1.6 [TRAINING]

STANDARD

ID	*Secondary Attribute*	*Specification*
5	Training Length	Provide equivalent of one hour of certified vendor classroom training for every TB of raw disk provided.
	Knowledge transfer	Work with VA staff as activities occur to ensure that VA can assume operational responsibility for the delivered solution.
	Documentation	Provide electronic copies of all materials, manuals, worksheets, etc. used in the delivery of the solution.

EXPLANATION OF STANDARD

Training Length – An initial complete training for VA staff is important for this project to succeed. An equivalent of one hour of certified vendor classroom training for every TB of raw disk provided, or more if the vendor believes this is needed.

VA support staff must have a level of trained knowledge provided to allow them to operate at a high level of expertise for day to day operations and standard problem resolution.

Knowledge transfer – While classroom training is important for the understanding of principles and procedures, actual knowledge transfer in regards to the implemented packages, how they work in the VA environment and potential improvement that may be available or upcoming is required.

Documentation – Initially all documentation for training, materials, worksheets, etc… for the initial installation must be provided in electronic format to ensure standard knowledge for all VA staff. As the product is changed and improved future training and documentation will also need to be provided.

Training documentation must be as complete as possible to allow for new VA staff to be able to understand and work with the vendor product.

EVALUATION FACTORS

- Vendor specific training that is oriented towards certification or “engineer” level training that is pertinent to properly managing and troubleshooting the product is preferred.
- Additional time/effort spent working with VA staff to ensure that the VA environment is optimized and meeting VA expectations is beneficial.
- When directly training VA staff printed as well as digital materials is beneficial to allow full potential of learning from staff.
- User forums for exchange of ideas and knowledge are preferred.

IMPLEMENTATION GUIDANCE

Any implementation that requires a strong base of knowledge for VA staff needs to have a planned training event set in place prior to installation to allow for full VA understanding and best potential for project implementation. While this training should be prior to installation it must not be so far in advance that newly learned skills/knowledge will become stale/obsolete by installation time.

In addition any installation that will occur near a time of a new patch or revision needs to ensure that the new knowledge is provided with the training.

3.2 [TIER 2 STORAGE SERVICE]

3.2.1 [STORAGE SUBSYSTEM HARDWARE (HW)]

STANDARD

ID	*Secondary Attribute*	*Specification*
	Workload	Capable to support Medium Performance such as Exchange Server, SQL Server, Virtual servers and generalized web servers with 25,000 or less concurrent users Workload.
	Minimum IO/sec	50,000 SPC-1 IOPS™ as measured by SPC-1 benchmark (http://www.storageperformance.org/results/)
	Minimum Throughput	1,000 SPC-2 MBPS™ as measured by SPC-2 benchmark (http://www.storageperformance.org/results/)
	Storage unit uptime	4'9s uptime.
	Universal Device ID value (UDID)	Changeable LUN UDID value is required.
	Redundancy	Fully redundant power supplies, cooling fans, component controllers, and others. All controllers within a single module will automatically fail over and load balance with one another. Controller module will support a minimum of two controllers.
	FC - Hosts to Storage Connectivity	Storage subsystems must support minimum four 4-Gbit/s Fiber Channel ports. Ability to support ports expansion to meet Tier 1 performance requirements in the same unit(s).
		Minimum two redundant multi-path connections from Host to Storage device. The Host connectivity throughput and performance will not be degraded even if 50% of the Host connectivity is lost.
	iSCSI - Hosts to Storage Connectivity	Storage subsystems must support minimum 1 Gb Ethernet connectivity with link aggregation. 10 Gb Ethernet support is preferred. Controller module will support a minimum of four Ethernet ports. Ability to support ports expansion in the same unit(s). Support Jumbo frame and LACP protocol.
		Minimum two redundant multi-path connections from Host to Storage device. The Host connectivity throughput and performance will not be degraded even if 50% of the Host connectivity is lost.

	SCSI Initiator (Host Connections)	Support a minimum of 256
	Replication	Capable of synchronous and asynchronous replication with write order fidelity.
	LUN creation	Ability to create LUN across all spindles.
	LUN Expansion	Dynamic LUN expansion is required.
	Storage provisioning	Capable of over-provisioning or Over-allocation storage capacity that allows hosts to view more storage capacity than has been physically reserved on the storage array itself
	Tiering capability	Using policies to move inactive data to lower tier of storage
	Deduplication	Minimum support post process deduplication.
	Snapshots	Capable of creating point in time delta snapshot Capable of creating space efficient snapshots on an as needed basis versus snapshot space reservation
	Clones	Capable of creating point in time delta clone Capable of creating space efficient clones on an as needed basis versus snapshot space reservation. Immediate access to clones before it is completed.
	Storage device scale up capability	Ability to upgrade controller/controller module on storage device without forklift upgrade.
		Adding or upgrading storage subsystem components adhering to the required storage device uptime requirement and no data migration
	Supported Disk type	Ability to support sufficient disk drive technologies to meet Tier 2 performance requirements.
	Return disk option	Non-return disk option is required
	Interoperability - Industry standards	Each storage subsystem must provide Storage Management Initiative Specification (SMI-S) 1.1 conforming provider (http://www.snia.org/ctp/conformingproviders)
	Firmware and microcode upgrade or updates	Completely non-disruptive to operations firmware and microcode upgrade or updates for all components with zero downtime are required.
	Boot from SAN	Storage subsystem will support boot from San.

	Operating system and file system compatibility	Must support operating systems and their associated file systems as listed in the TRM.
	Applications compatibility (minimum)	Applications listed by VA Technical Reference Model (TRM) for enterprise deployment.
	Redundant Array of Independent Disk (RAID) levels	Minimum support for RAID 0+1/10/5/6 in same subsystems.
	RAID group size	Vendor offering must be able to meet storage capacity without exceeding 7 TB RAID group size and without exceeding 7 data drives.
	Power switches	Master power switches must be covered to prevent inadvertent activation.
	Standardized layouts	Components must be mounted in standardized configurations for all VA installations.
	Additional servers	Refer to Server Standard, Section Class C Server
	Role-based access	Solution must include security configurations that support role-based access required to limit functions during normal and COOP operation.
	Documentation	Provide detail design solution documents and drawings. All design methods and calculations to achieve the performance requirements must be clearly stated in the document. All assumptions if any must be included in the design document

EXPLANATION OF STANDARD

Workload – The storage system must be able to handle the amount of data and transactions that accompany large shared enterprise level applications with high amounts of transactions and large amounts of I/O. Capable of supporting medium and high performance workloads such as OLTP databases (Cache/IDMS/Oracle/SQL) with less than 25,000 concurrent users, VistA, Microsoft Exchange, general web and application servers and virtualized platforms.

Minimum IO/sec - The SPC-1 minimum benchmark as identified in this standard provides for a independent and objective measuring tool with regards to IOPS (Input/Output operations per second) for which all potential SAN Solutions can be gauged. Specific test include OLTP, database operations and mail server implementations. Specifically SPC-1 is defined by www.storageperformance.com as "a single workload designed to demonstrate the performance of a storage subsystem while performing the typical functions of business critical applications. Those applications are characterized by predominately random I/O operations and require both queries as well as update operations". **The specific benchmark value was determined based on analysis of major vendor SPC benchmark submissions.**

Minimum Throughput - The SPC-2 minimum benchmark as identified in this standard provides for an independent and objective measuring tool with regards to MBPS (megabits per second) transfer rates for which all potential SAN Solutions can be gauged. Specific tests include large file processing, large database queries and video on demand (VOD). Specifically SPC-2 is defined by www.storageperformance.com as "three distinct workloads designed to demonstrate the performance of a storage subsystem during the execution of business critical applications that require the large-scale, sequential movement of data. Those applications are characterized predominately by large I/Os organized into one or more concurrent sequential patterns. A description of each of the three SPC-2 workloads is listed below as well as examples of applications characterized by each workload". **The specific benchmark value was determined based on analysis of major vendor SPC benchmark submissions.**

Storage unit uptime- In normal operation, the subsystem should not require more than fifty two minutes interruption in a year for software upgrade or component replacement. Uptime is all connected hosts able to continue processing data. Additional Information can be gathered at http://www.uptimeinstitute.org.

Universal Device ID value (UDID) – In OpenVMS hosts must have a unique unit device identifier (UDID) for each accessible disk volume. To enable this, the subsystem must enable control over UDID assignment so that different disk arrays will not present the same UDID to the OpenVMS host.

Redundancy – Failure of a single component will not stop storage system operation in any capacity. Fully redundant storage systems are critical to the continuing processing and to maintain system stability.

FC – Host to Storage Connectivity – Storage subsystem must have multiple 4 Gb/second connectivity. An 8/GB connection is highly desirable.

iSCSI – Hosts to Storage Connectivity - For interoperability the SAN Solution that is procured must provide current iSCSI capabilities of 1GB current connectivity and the ability to upgrade to future higher speed connectivity. Additionally, Link Aggregation with dual NICS support is required.

SCSI Initiators (host connections) – a SCSI initiator is the host-side endpoint of a SCSI session. Every redundant host connection requires two SCSI initiators.

Replication – Replication is typically a software function, but hardware must support replication

LUN creation – The ability to create LUN's 'on the fly' without outage to the system and without disruption to the host systems.

LUN Expansion – Ability to add space to a LUN without rewriting data on that LUN.

Storage provisioning – Commonly called "thin provisioning". Thin provisioning is typically a software function, but hardware must support it.

Tiering capability - Manually or automatic policies to move inactive data to lower tier of storage, either in same or other frame. Tiering is typically a software function, but hardware must support it.

Deduplication – Data Deduplication is a technology strives to reduce the amount of duplicate data being backed up and then stored. The technologies identify and eliminate common data in and across backup streams. By eliminating the common objects, the resulting storage requirement will be reduced.

Global deduplication comes into play when you have multiple deduplication devices. With multiple deduplication devices nodes, when data that is seen before by one node is sent to a second node, the second node knows that data has already been stored and it will not be stored for a second time.

Snapshots – Snapshots are typically a software function, but hardware must support data snapshots (copy on write)

Clones – LUN cloning is typically a software function, but hardware must support data clone (full copies)

Storage device scale up capability – Upgrade controllers, cache or drives within same cabinets/footprint. Add controllers, cache, cabinets or drives without interrupting service or data migration.

Supported Disk type - As a minimum the SAN solution will provide the ability to utilize and support Fibre Channel drives, SATA drives and any near horizon drive technology (i.e. Solid State Drives) within the same SAN system.

Return disk option - As part of the support contract any failed disk within the SAN device or accompanying management servers will not be returned to the vendor. They will be maintained, secured and destroyed in accordance with applicable VA regulations with regards to data destruction.

Interoperability - Industry standards - for consistency and to ensure that the SAN Solution provided meets the criteria set forth by both Industry Standards and the VA Standard a baseline of specifications are needed. These specifications are best indicated by the Storage Management Initiative Specification (SMI-S) which was developed by leading storage equipment and software providers.

Firmware and microcode upgrade or updates - The capabilities to perform firmware and microcode updates without interrupt to the operations of the SAN and hosts devices connected there to. This is to include, but not limited to, disk firmware, controller firmware, controller software, and internal SAN Fabric switches.

SAN boot support (minimum) - The ability to provide the operating system of a host server to boot directly from the SAN device without local server disks is required. Please see the Operating Systems as listed in VA Technical Reference Model.

Operating system compatibility (minimum) - Please see the Operating Systems as listed in VA Technical Reference Model (TRM). The current VA TRM will be provided by COTR during acquisition process

Applications compatibility (minimum) - Please see the Applications as listed in VA Technical Reference Model. The current VA TRM will be provided by COTR during acquisition process.

Redundant Array of Independent Disk (RAID) levels - Due to the varying needs and uses the SAN Solution will be required to support the capabilities of RAID1, RAID5 and RAID6 in the same storage subsystems and disk enclosure. While above is a minimum RAID levels additional RAID configuration support is desired.

RAID group size - The size limit for a RAID group must not exceed 7TB in order to obtain optimal performance. The size requirement for a RAID group is based on the ability to rebuild the RAID group following a disk failure. Based on a drive MTTF of 1,000,000 hours, a RAID-5 group larger than 7 TB has a high risk of not being able to successfully rebuild without an unrecoverable error (URE). The existence of 7 drives to a RAID set is optimal and is the recommend amount to be allocated to any given RAID drive set.

Power switches - In addition to being redundant all power switches and power plugs must be properly secured and encased to ensure that they cannot be accidentally tripped, unseated or create any situation where power will be disrupted to the devices they are providing power to.

Standardized layouts - The layout of the solution must be a consistent design that is in use at all datacenters that are keeping with VA standards. This approach allows for the redistribution of the equipment to different sites and the most efficient use of data center space.

Additional servers - SAN support is often managed via a dedicated server(s). These hosts must be supported by the same support contract and remote management. Additionally all host must adhere to all the VA security policies and procedures with relation to servers, must be FIPS140-2 compliant and have only VA approved software installed.

Role-based Access - The ability for the applicable support personnel to manage the SAN solution and support servers from an industry standard out of band management solution is required and critical. Due to the remote nature and decentralized nature of support personnel must be able to access the SAN and servers even while shutdown or during BIOS/POST operations.

Documentation - Documentation must be provided that is described in the standard that allows for the complete understanding of the solution that is implemented. The importance of this is to create a seamless handoff from the varying organizations that will be supporting the SAN solution.

EVALUATION FACTORS

Lowest Total Cost of Ownership (TCO) solution that meets the performance requirements is preferred. Components considered are small footprint, power consumption, cooling, Hardware, Software, license, Overhead cost of managing the devices, Ease of Management, Acquisition cost, Maintenance and deployment costs, storage capacity (such as number of data copies),Information Lifecycle Management(ILM) cost.

Workload – The use of industry standard tools and benchmarks to provide adequate levels of validation during the acquisition process is critical to ensure the system procured can handle the rigors and high demands set forth in this tier.

Minimum IO/sec - The threshold of 50,000 IOPS using this SPC-1 benchmark has been identified as the minimum to provide the needs of the VistA application.

Minimum Throughput -The threshold of 1,000MBPS using this SPC-2 benchmark has been identified as the minimum to provide the needs of the VistA application.

Storage unit uptime – REQUIRED as defined in the standard above for this Tier. This would be 4 nines which equates to 52.6 minutes per year.

Universal Device ID value (UDID) - Required **in** order to support all the Operating Systems that may utilize the procured storage subsystem.

Redundancy – REQUIRED Redundant components are needed to ensure the failure of one component of the storage system will not cause an outage.

FC – Hosts to Storage Connectivity – REQUIRED **4**/GB connections however 8/GB connections are highly desirable and requested.

iSCSI – Hosts to Storage Connectivity – REQUIRED with minimum current iSCSI capabilities of 1GB connectivity with 10GB preferred and or expandable to in future.

SCSI Initiators (host connections) – a SCSI initiator is the host-side endpoint of a SCSI session. Every redundant host connection requires two SCSI initiators. The greater the available space to be assigned (usable) the more initiators would be required. Suggest at least one SCSI initiator for every two drive slots or 256 minimum.

Replication – Storage subsystem must support asynchronous and synchronous HA and DR replication

LUN Creation – LUN creation is a must in the type of environment that this tiered solution will be placed.

LUN Expansion – REQUIRED

Storage provisioning – Function included in cost. Thin provisioning is typically a software function, but hardware must support it.

Tiering capability – Function included in cost. Thin provisioning is typically a software function, but hardware must support it. Array needs to support or include multiple drive types or if tiering will be between multiple storage subsystems of heterogeneous types.

Deduplication – Source, target, inline, or post process deduplication. The deduplication method used must not degrade overall application performance, storage performance, and will not reduce backup windows. Support Global deduplication is preferred.

Capable of perform both file-level, and block-level data deduplication is preferred.

Capable of perform both file-level and block-level data deduplication on primary storage is preferred.

Snapshots – Compare limits on number of snapshots that can be made of a primary storage LUN

Clones – Compare limits on number of snapshots that can be made of a primary storage LUN

Storage device scale up capability – REQUIRED Evaluate based on expandability of usable storage in TB

Supported Disk type - REQUIRED the supported disk type must be specified in all documentation as to the exact type, speed and capacity.

Return disk option - REQUIRED To be documented in the procurement that no failed disks will be returned to vendor or leave in the possession of the VA at all times until properly disposed.

Interoperability – Industry standards – REQUIRED the supporting documentation should be presented and validated during the acquisition process. These specifications are SMI-S v1.1 as described at: http://www.snia.org/forums/smi/tech_programs/smis_home/

Firmware and microcode upgrade or updates – REQUIRED the means at which the vendor's solution will accomplish this task needs to be documented and tested prior to acceptance of the solutions.

SAN boot support (minimum) - REQUIRED to support the operating systems listed are required within this document

Operating system compatibility (minimum) – At a minimum the supported solution will provide OS support for Windows based Operating System, Linux Based Operating System, UNIX based Operating System and OpenVMS Operating System. The current VA TRM will be provided by COTR during acquisition process.

Applications compatibility (minimum) – The current VA TRM will be provided by COTR during acquisition process.

Redundant Array of Independent Disk (RAID) levels should meet the current and future needs of the VA. While the current VistA "Production data" resides on mirrored RAID1 drives the ability to augment them with addition RAID types is important. Raid group sizing limitations of Terabytes and number of physical drives is needed and should be evaluated as part of the acquisition process.

RAID group size - The size limit for a RAID group must not exceed 7TB in order to obtain optimal performance. The total number of drives assigned to a particular RAID set must not exceed seven physical drives. This is to ensure the integrity of the RAID group.

Power switches - All power switches and power plugs must be properly secured and encased

Standardized layouts - Layout and plan design will need to be validated during the acquisition process

Additional servers - All additional servers should be identified during the procurement process and keep with the VA Server Standards.

Role-based Access - Refer to Server Standard, Section Class C Server

Documentation - Cost of documentation should be identified and included in the procurement process. Vendor shall provide electronic, three dimensional models of equipment proposed for use with CAD and visual design/planning applications.

IMPLEMENTATION GUIDANCE

Lowest Total Cost of Ownership (TCO) solution that meets the performance requirements is preferred.

Workload- The use of industry standard tools and benchmarks to provide adequate verifications levels during acceptance testing

Minimum IO/sec – Include validation in acceptance testing

Minimum Throughput – Include validation in acceptance testing

Storage Unit Uptime – Include validation in acceptance testing

Universal Device ID value (UDID) – Include validation in acceptance testing

Redundancy – Include validation in acceptance testing**.** Component failure testing should occur prior to putting into production. This should include a planned failure of a single component to ensure the backup/ secondary component provides adequate coverage to verify no outage of the storage system.

FC - Hosts to Storage Connectivity – Recommend 8/GB Fibre Channel connections to host.

iSCSI - Hosts to Storage Connectivity – Include validation in acceptance testing

iSCSI Initiator (Host Connections) - Include validation in acceptance testing

Replication – Testing of the replication process should occur during acceptance testing.

LUN Creation - Testing and actual creation for production should occur during acceptance testing to provide validation.

LUN Expansion – Include validation in acceptance testing

Storage Provisioning – Include validation in acceptance testing

Tiering Capability – If software is in place and capabilities exist the testing of this function should be conducted from this tier to a lower (or higher) tier.

Deduplication – Must test and validate to ensure the deduplication method used does not degrade overall application performance, storage performance, and will not reduce backup windows. Test and validate to ensure Global deduplication only process on copy of data among sites.

Snapshots – Include validation in acceptance testing

Clones – Include validation in acceptance testing

Supported Disk type - Fibre Channel and iSCSI are needed at a minimum.

Return disk option - Not applicable other than being aware of if any disk failure during implementation.

Interoperability – Industry standards - The standards which are provided in the sections above must be adhered to and validated during the implementation phase using the common set of tools identified in the SMI-S v1.1.

Firmware and microcode upgrade or updates - The means this is achieved by the SAN Solution needs to be tested.

SAN boot support (minimum) – Test and implement during installation with validation in acceptance testing

Operating system compatibility (minimum) - Include validation in acceptance testing

Applications compatibility (minimum) - Include validation in acceptance testing

Redundant Array of Independent Disk (RAID) levels - Include validation in acceptance testing

RAID group size - Include validation in acceptance testing

Power switches - All power switches and power plugs must be properly secured and encased. This also includes the proper covering of any emergency cutoff switches.

Standardized layouts - Ensure that all layouts conform to VA Standard and are validated during installation.

Additional servers - Operating System and Applications must be VA Server Standard. The current VA TRM will be provided by COTR during acquisition process. Refer to Server Standard, Section Class C Server

Role-Based Access – Described and documented in the support contract.

Documentation - All documentation should be in the form in a standard form that can be used by all VA support staff (i.e. Word documents, pdf or Visio).

3.2.2 [STORAGE MANAGEMENT SOFTWARE]

STANDARD

ID	*Secondary Attribute*	*Specification*
	Enterprise license not based on capacity	Software licenses provided must be perpetual with a five-year support and update subscription, with all licenses and rights transferred to the Government at the time the installation is completed. Licenses must be transferable without limitation and provisioned as a VA enterprise license, without additional storage allocation-based charges, such as per GB or TB.
	Interoperability	Management software must be listed as a Storage Networking Industry Association (SNIA) SMI-S 1.1 conforming client. (http://www.snia.org/forums/smi/tech_programs/ctp/smi_conform/smi_client/smi_client_definitions.
	Storage Reporting	Storage reporting components suitable for use in a fee for service, chargeback environment. Automated reports of storage allocations must be capable of being generated by non-IT staff. Must support ODBC and/or JDBC connectivity.
	Automated tools for LUN provisioning	The software should have automated tools to provision a large number of Disk Groups and LUNs. Similarly, an automated solution should be provided to configure hosts with large numbers of logical disks.
	Proactive monitoring and remote notification	The management tool must be capable of proactive monitoring and remote notification of system and application health. Must support ODBC and/or JDBC connectivity.
	Single storage management console	Storage hardware must be manageable from a single storage management application and with the capability of automatic discovery of equipment connected to the SAN.
	Additional servers	Refer to Server Standard, Section Class C Server
	Management server security	Refer to Server Standard, Section Class C Server
	Data snapshot (local)	License and annual maintenance (5 years) as required for software to support array-based point-in-time data images suitable for use for administrative tasks such as online backup & testing with no impact to source data and minimal additional space requirements.

	Performance analysis	Performance management software to monitor, analyze and report on all solution components (i.e. from host to fabric to storage). This includes storage subsystems, software operations, SAN infrastructure, replication and telecommunications. Software should be able to identify and analyze response time, and other relevant metrics to enable identification and resolution of potential bottlenecks. The tool must support OpenVMS client operating system. All management software must be ODBC and/or JDBC connectivity.
	Storage Capacity planning	The software must be able to analyze current capacity and forecasts future system requirements. The software should be able to collect component data to project future usage of the storage system.
	Local copy	License and annual maintenance (5 years) as required for software to support local array-array LUN copy/replication.
	Consistent design	All software should use identical components where possible to facilitate common updates across the solution.

EXPLANATION OF STANDARD

Enterprise license not based on capacity – to include 5 years of support as required for enterprise SAN Management application. Licenses must be transferable without limitation and provisioned as a VA enterprise license, without additional storage allocation-based charges, such as per GB or TB.

Interoperability - Management software must be listed as a Storage Networking Industry Association (SNIA) SMI-S 1.1 conforming client.
(http://www.snia.org/forums/smi/tech_programs/ctp/smi_conform/smi_client/smi_client_definitions

Storage Reporting – Access level reporting with the ability to generate reports by non-IT staff.

Automated tools for LUN provisioning - a single, intelligent interface that allows you to provision storage systems and fabric switches from end-to-end. The software should have automated tools to provision a large number of Disk Groups and LUNs along with the ability to configure hosts with large numbers of logical disks.

Proactive monitoring and remote notification - Storage Management software must be capable of monitoring and remote notification in the event of an alert, failure or the inability of the system to meet the customer's SLA's. Provisioning actions to trigger events, SNMP traps, and policies for notification. Ability to send email or custom scripts or programs for notification.

Single Storage Management console – Storage hardware must be manageable from a single storage management application.

Data snapshot (local) - License and annual maintenance (5 years) as required for software to support array-based point-in-time data images suitable for use for administrative tasks such as online backup & testing with no impact to source data and minimal additional space requirements.

Performance analysis – Storage management software to monitor, analyze and report on all solution components (i.e. from host to fabric to storage). This includes storage subsystems, software operations, SAN infrastructure, replication and telecommunications. Software should be able to identify and analyze response time, and other relevant metrics to enable identification and resolution of potential bottlenecks.

Storage Capacity planning - The software must be able to analyze current capacity and forecasts future system requirements. The software should be able to collect component data to project future usage of the storage system.

Local copy - License and annual maintenance (5 years) as required for software to support local array-array LUN copy/replication.

Consistent Design – All software should use identical components where possible to facilitate common updates across the solution.

EVALUATION FACTORS

- Enterprise Level Storage Management software
- Ability to manage multiple devices
- Enterprise License w/5years annual maintenance
- Storage Management Reporting
- Performance Monitoring
- Single Storage management console
- Ability to Manage events and policies

IMPLEMENTATION GUIDANCE

Implementation should include all optional software needed to meet the requirements listed above. Licensing and maintenance terms should the Hardware/Software Technical Support sections of this document. Professional implementation services should be included along with “classroom” training for support staff as outlined in the Training sections of this document.

3.2.3 [HARDWARE/SOFTWARE TECHNICAL SUPPORT]

STANDARD

ID	***Secondary Attribute***	***Specification***
	Support procedures	Documented support/escalation procedure for all components of the solution.
	Support Availability	Software support required 24x7x365 for all software provided in the solution. License and annual maintenance 3 years with 2 extension years.
		Hardware Maintenance/Support 5 yr, 24x7x365, 4 hour response time is required.
	License transfer	Licenses can be transferred without limitation within the Department of Veterans Affairs.
	OEM resources	Direct access to on-line OEM vendor support incident information and tracking.
	Support Interface	All VA datacenters must have access to incident information and tracking for all VA datacenters.
	Disruptive patches	Describe any type of updates/patch that would require a hosted service outage of the solution.
	SLAs	Documented Service Level Agreements (SLAs) for support requests.
	Professional services	Include cost of any professional services for services that must be completed by the vendor.

EXPLANATION OF STANDARD

Support procedures – A documented (digital & printed) set of instructions and escalation procedures to include updated contact information for the appropriate point of contact while troubleshooting problems. This will be a living document and as such digital copies should have supplements/replacements provided quarterly to ensure the most up to date procedures are available for the customer.

A concisely documented set of procedures is essential for communication between the customer and the support staff, allowing for all parties to know when priority escalation occurs, how it occurs, and the proper path for the expedited resolution.

Support Availability – Due to the criticality of these systems, full round the clock support is essential for a minimum of the first year, with options available to extend for the following four years allowing for a total of five years. In addition a minimal 4 hour response time in regards to hardware maintenance is required.

License transfer – All pertinent licenses must be capable of being transferred between various VA sites and cannot be restricted by location. Due to the nature of the OI&T structure for the VA licenses must be capable of being transferred within the various physical locations without restriction.

OEM resources – Direct communication paths to the knowledge experts of a product is key for fast response and ensuring the systems remain operational at the levels needed. Being required to go through middlemen in efforts to funnel trouble calls is not suitable to the nature of these systems.

Speaking directly with the product expert allows for potential miscommunication errors to be avoided. Being able to go directly to the appropriate level of tier knowledge on a failure is essential for ensuring that the problem is communicated correctly and quickly the best support engineer that can assist the customer.

Support interface – Due to many VA experts working across various regions and areas it is vital for all site's to be able to access VA wide information for troubleshooting and sharing of information.

VA I.T. support is organized through a central Office of Information Technology and is required to assist each various region/area as needed. Support contact and information should not be limited to a locality and must allow for access across the VA areas.

Disruptive patches – Ideally updates/patches will be able to be implemented with 0% system downtime. Any operations that would require a system outage needs to be documented and provided for review.

VA standards require that all disruptions be documented, submitted, and tracked to resolution. Known procedures that require disruption of service need to be documented and said documentation made available. Support engineers will need to work with VA staff to ensure that the required procedures for disruptions are followed.

SLAs - Documented Service Line Agreements (SLAs) for support request will be provided and the Vendor will ensure that there is no confusion between VA staff and Vendor on expectations.

Professional services – Provide a full disclosure of vendor specific services that must be provided by the vendor only. I.E. Some storage systems require a vendor engineer to flash firmware or similar upgrades and do not allow the customer to perform such actions.

VA standards require that outside contractors be escorted and/or evaluated for security requirements. All expected procedures that require vendor services need to be provided and a list of potential engineers that will be onsite updated as needed to ensure the engineer can gain access.

EVALUATION FACTORS

- Quality of documentation to include ease of finding information, extent of informative data, and usability in regards to trouble shooting and technical support will be considered.

- Direct phone contact for immediate escalation of troubleshooting over email, web interface, or other "automated" trouble shooting requests will be preferred.
- While direct access to product experts are needed, having a support engineer/contact to supervise and ensure that all experts are moving forward with the end goal of problem expedient problem resolution is preferred.
- Central/Single Interface for multiple sites to track VA related problems will be preferred.
- Minimum amount of scheduled downtime for patching/updating and supporting evidence for such is preferred.
- Path of communication for VA to suggest improvements and see improvements implemented is beneficial.
- Forums or other user group discussion areas are beneficial.
- Lower on-site response time is beneficial.
- Lower initial "engineer level" contact response time is beneficial.
- Lower time-to-repair is beneficial.
- Vendor-supplied components stocked as spares near, or at, facility is beneficial.
- Penalty clauses for vendor not meeting support contract provides is beneficial.

IMPLEMENTATION GUIDANCE

Coordination with initial VA staff for knowledge transfer and verified understanding is important. Continuing contact with VA staff to ensure support procedures are viable and procedures in place for VA input to improve support/product is essential.

3.2.4 [HARDWARE/SOFTWARE INSTALLATION]

STANDARD

ID	***Secondary Attribute***	***Specification***
	Installation	Provide hardware/software installation, including initial configuration, Storage Area Network configuration & knowledge transfer.
	Pre-configuration	Rack mount and configure the solution (including servers and storage where possible) prior to shipping it to the VA. This minimizes the on-site installation time as well as the number of crates and boxes that must be received and tracked by VA.
	Onsite impact	All on-site activities must be conducted in such a manner as to minimize the impact to normal information systems operations.
	Necessary software/hardware	Provide all necessary hardware and software, including all necessary cables and mounting hardware to make the Solution operational, except government-furnished property (GFP) referenced in GFP section.
	Delivery	Provide inside delivery, installation and insurance of all equipment to VA datacenters. The VA does not accept delivery of the equipment until acceptance testing is passed at all VA datacenters.
	Trash	Remove all trash associated with shipping, delivery and installation.
	OS installation and security	Refer to Server Standard, Section Class C Server

EXPLANATION OF STANDARD

Installation - Provide planning, configuration and tentative schedule for the initial installation. This planning should involve collaborating with customer technical personnel to insure any and all critical elements and requirements regarding the environment are communicated. This process is envisioned as a collaborative effort between the vendor and customer with the end result being an installation that is 100 percent complete, functional and fully documented and the customer understanding everything needed to operate and maintain the system. This also includes demonstrating the steps necessary to backup and restore the system to a fully functional state. This entire process is to be conducted in such a manner as to minimize the impact to normal information systems operation.

Pre-configuration - To shorten the installation process and better utilize the time vendor personnel are on-site it is required pre-racking and pre-configuring the solution as much as possible prior to delivery. This includes working with customer personnel to develop any custom software images and preload the images prior to shipping.

Restorable images – In addition to having hardware preloaded with software a process must be in place to have restorable images for these systems as a backup to needing to overwrite/restore an existing image during install. Custom DVD's, portable storage, etc… are all viable options to having the image onsite for quick access and use.

Onsite impact – Minimal impact on the site facility is required. Efforts will be taken by the Vendor to ensure that the prep, assembly, install, and testing of the Solution will be done in a professional manner with minimal impact upon local site. Concern in regards to trash, path blockage, unsecured equipment, excessive levels of noise, etc… should be considered and action taken accordingly.

Necessary software/hardware – Aside from government-furnished property (GFP) referenced in the GFP section, all software and hardware required to make the Solution operational will be provided by the Vendor. This is to include but not limited to: cables, mounting brackets, screws, install software, testing equipment, etc…

Delivery – The Vendor will take responsibility of ensuring that all materials are delivered into the facility install location and the materials will remain the responsibility of the Vendor until acceptance testing is passed at all VA datacenters.

Trash – The Vendor will take responsibility of the removal of all trash from the facility, including but not limited to: boxes, packing materials, plastic bags, ties, etc…

OS installation and security – Following existing documentation provide by the VA Platform Server Team ensure all Operating systems and Security applications are installed accordingly.

EVALUATION FACTORS

- It is considered beneficial if the vendor can detail a delivery, installation and configuration plan for the equipment the vendor is proposing.
- Any demonstration that equipment can be pre-racked, pre-configured or pre-imaged is considered beneficial
- Verification that images can be restored onsite instead of remotely for install purposes is preferred.
- A basic plan to show minimal impact during installation and setup with certified technicians to follow this plan is preferred. Vendor hiring lowest cost "IT Talent" is not preferred.
- Checklists of hardware and software installation needs and verified availability of these is beneficial.

IMPLEMENTATION GUIDANCE

As much Vendor/VA staff preinstall communication to ensure full understanding is recommended.

Vendor verification of hardware fitting and requirements prior to install is required. Finding out at install that a piece of equipment does not fit or does not have all the install equipment is not acceptable.

All documentation, software, and hardware required for installation and operation of the Solution as well as training materials need to be onsite and verified for installation.

3.2.5 [TRAINING]

STANDARD

ID	*Secondary Attribute*	*Specification*
	Training Length	Provide equivalent of one hour of certified vendor classroom training for every TB of raw disk provided.
	Knowledge transfer	Work with VA staff as activities occur to ensure that VA can assume operational responsibility for the delivered solution.
	Documentation	Provide electronic copies of all materials, manuals, worksheets, etc. used in the delivery of the solution.

EXPLANATION OF STANDARD

Training Length – An initial complete training for VA staff is important for this project to succeed. An equivalent of one hour of certified vendor classroom training for every TB of raw disk provided, or more if the vendor believes this is needed.

VA support staff must have a level of trained knowledge provided to allow them to operate at a high level of expertise for day to day operations and standard problem resolution.

Knowledge transfer – While classroom training is important for the understanding of principles and procedures, actual knowledge transfer in regards to the implemented packages, how they work in the VA environment and potential improvement that may be available or upcoming is required.

Documentation – Initially all documentation for training, materials, worksheets, etc… for the initial installation must be provided in electronic format to ensure standard knowledge for all VA staff. As the product is changed and improved future training and documentation will also need to be provided.

Training documentation must be as complete as possible to allow for new VA staff to be able to understand and work with the vendor product.

EVALUATION FACTORS

- Vendor specific training that is oriented towards certification or “engineer” level training that is pertinent to properly managing and troubleshooting the product is preferred.
- Additional time/effort spent working with VA staff to ensure that the VA environment is optimized and meeting VA expectations is beneficial.
- When directly training VA staff printed as well as digital materials is beneficial to allow full potential of learning from staff.
- User forums for exchange of ideas and knowledge are preferred.

IMPLEMENTATION GUIDANCE

Any implementation that requires a strong base of knowledge for VA staff needs to have a planned training event set in place prior to installation to allow for full VA understanding and best potential for project implementation. While this training should be prior to installation it must not be so far in advance that newly learned skills/knowledge will become stale/obsolete by installation time.

In addition any installation that will occur near a time of a new patch or revision needs to ensure that the new knowledge is provided with the training.

3.3 [TIER 3 STORAGE SERVICE]

3.3.1 [STORAGE SUBSYSTEM HARDWARE (HW)]

STANDARD

ID	*Secondary Attribute*	*Specification*
	Workload	Capable to support Small and Low Performance Workload. Target performance would be retrieval of data file of 10 MB within 60 seconds of request.
	Minimum IO/sec	20,000 SPC-1 IOPS™ as measured by SPC-1 benchmark (http://www.storageperformance.org/results/))
	Minimum Throughput	1,000 or less SPC-2 MBPS™ as measured by SPC-2 benchmark (http://www.storageperformance.org/results/)
	Storage unit uptime	4'9s uptime.
	Universal Device ID value (UDID)	Not applicable.
	Redundancy	Fully redundant power supplies, cooling fans, component controllers, and others. All controllers within a single module will automatically fail over and load balance with one another. Controller module will support a minimum of two controllers.
	FC - Hosts to Storage Connectivity	Storage subsystems must support minimum four 4-Gbit/s Fiber Channel ports. Ability to support ports expansion to meet Tier 1 performance requirements in the same unit(s).
		Minimum two redundant multi-path connections from Host to Storage device. The Host connectivity throughput and performance will not be degraded even if 50% of the Host connectivity is lost.
	iSCSI - Hosts to Storage Connectivity	Storage subsystems must support minimum 1 Gb Ethernet connectivity with link aggregation. 10 Gb Ethernet support is preferred. Controller module will support a minimum of four Ethernet ports. Ability to support ports expansion in the same unit(s). Support Jumbo frame and LACP protocol.
		Minimum two redundant multi-path connections from Host to Storage device. The Host connectivity throughput and performance will not be degraded even if 50% of the Host connectivity is lost.
	SCSI Initiator (Host	Support a minimum of 256

	Connections)	
	Replication	Capable of synchronous and asynchronous replication with write order fidelity.
	LUN creation	Ability to create LUN across all spindles.
	LUN Expansion	Dynamic LUN expansion is required.
	Storage provisioning	Capable of over-provisioning or Over-allocation storage capacity that allows hosts to view more storage capacity than has been physically reserved on the storage array itself
	Tiering capability	Using policies to move inactive data to lower tier of storage
	Deduplication	Capable of supporting post process data deduplication.
	Snapshots	Capable of creating point in time delta snapshot Capable of creating space efficient snapshots on an as needed basis versus snapshot space reservation
	Clones	Capable of creating point in time delta clone Capable of creating space efficient clones on an as needed basis versus snapshot space reservation. Immediate access to clones before it is completed.
	Storage device scale up capability	Not applicable
	Supported Disk type	Ability to support sufficient disk drive technologies to meet Tier 3 performance requirements.
	Return disk option	Non-return disk option is required
	Interoperability - Industry standards	Each storage subsystem must provide Storage Management Initiative Specification (SMI-S) 1.1 conforming provider (http://www.snia.org/ctp/conformingproviders)
	Firmware and microcode upgrade or updates	Completely non-disruptive to operations firmware and microcode upgrade or updates for all components with zero downtime are required.
	Boot from SAN	Storage subsystem will support boot from San.
	Operating system and file system compatibility	Must support operating systems and their associated file systems as listed in the TRM.

	Applications compatibility (minimum)	Applications listed by VA Technical Reference Model (TRM) for enterprise deployment.
	Redundant Array of Independent Disk (RAID) levels	Minimum support for RAID 0+1/10/5/6 in same subsystems.
	RAID group size	Vendor offering must be able to meet storage capacity without exceeding 7 TB RAID group size and without exceeding 7 data drives.
	Power switches	Master power switches must be covered to prevent inadvertent activation.
	Standardized layouts	Components must be mounted in standardized configurations for all VA installations.
	Additional servers	Refer to Server Standard, Section Class C Server
	Role-based access	Solution must include security configurations that support role-based access required to limit functions during normal and COOP operation.
	Documentation	Provide detail design solution documents and drawings. All design methods and calculations to achieve the performance requirements must be clearly stated in the document. All assumptions if any must be included in the design document

EXPLANATION OF STANDARD

Workload – Capable of supporting low to medium performance workloads such as such as non-time sensitive operations and data archiving. Target performance would be retrieval of data file of 10 MB within 60 seconds of request.

Minimum IO/sec - The SPC-1 minimum benchmark as identified in this standard provides for a independent and objective measuring tool with regards to IOPS (Input/Output operations per second) for which all potential SAN Solutions can be gauged. Specific test include OLTP, database operations and mail server implementations. Specifically SPC-1 is defined by www.storageperformance.com as "a single workload designed to demonstrate the performance of a storage subsystem while performing the typical functions of business critical applications. Those applications are characterized by predominately random I/O operations and require both queries as well as update operations". **The specific benchmark value was determined based on analysis of major vendor SPC benchmark submissions.**

Minimum Throughput - The SPC-2 minimum benchmark as identified in this standard provides for an independent and objective measuring tool with regards to MBPS (megabits per second) transfer rates for which all potential SAN Solutions can be gauged. Specific tests include large file processing, large database queries and video on demand (VOD). Specifically SPC-2 is defined by www.storageperformance.com as "three distinct workloads designed to demonstrate the performance of a storage subsystem during the execution of business

critical applications that require the large-scale, sequential movement of data. Those applications are characterized predominately by large I/Os organized into one or more concurrent sequential patterns. A description of each of the three SPC-2 workloads is listed below as well as examples of applications characterized by each workload". **The specific benchmark value was determined based on analysis of major vendor SPC benchmark submissions.**

Storage unit uptime- In normal operation, the subsystem should not require more than fifty two minutes interruption in a year for software upgrade or component replacement. Uptime is all connected hosts able to continue processing data. Additional Information can be gathered at http://www.uptimeinstitute.org.

Redundancy – Failure of a single component will not stop storage system operation in any capacity. Fully redundant storage systems are critical to the continuing processing and to maintain system stability.

FC – Host to Storage Connectivity – Storage subsystem must have multiple 4 Gb/second connectivity. An 8/GB connection is highly desirable.

iSCSI – Hosts to Storage Connectivity - For interoperability the SAN Solution that is procured must provide current iSCSI capabilities of 1GB current connectivity and the ability to upgrade to future higher speed connectivity. Additionally, Link Aggregation with dual NICS support is required.

SCSI Initiators (host connections) – a SCSI initiator is the host-side endpoint of a SCSI session. Every redundant host connection requires two SCSI initiators.

Replication – Replication is typically a software function, but hardware must support replication

LUN creation – The ability to create LUN's 'on the fly' without outage to the system and without disruption to the host systems.

LUN Expansion – Ability to add space to a LUN without rewriting data on that LUN.

Storage provisioning – Commonly called "thin provisioning". Thin provisioning is typically a software function, but hardware must support it.

Tiering capability - Manually or automatic policies to move inactive data to lower tier of storage, either in same or other frame. Tiering is typically a software function, but hardware must support it.

Deduplication – Data Deduplication is a technology strives to reduce the amount of duplicate data being backed up and then stored. The technologies identify and eliminate common data in and across backup streams. By eliminating the common objects, the resulting storage requirement will be reduced.

Global deduplication comes into play when you have multiple deduplication devices. With multiple deduplication devices nodes, when data that is seen before by one node is sent to a second node, the second node knows that data has already been stored and it will not be stored for a second time.

Snapshots – Snapshots are typically a software function, but hardware must support data snapshots (copy on write)

Clones – LUN cloning is typically a software function, but hardware must support data clone (full copies)

Supported Disk type - As a minimum the SAN solution will provide the ability to utilize and support Fibre Channel drives, SATA drives and any near horizon drive technology (i.e. Solid State Drives) within the same SAN system.

Return disk option - As part of the support contract any failed disk within the SAN device or accompanying management servers will not be returned to the vendor. They will be maintained, secured and destroyed in accordance with applicable VA regulations with regards to data destruction.

Interoperability - Industry standards - for consistency and to ensure that the SAN Solution provided meets the criteria set forth by both Industry Standards and the VA Standard a baseline of specifications are needed. These specifications are best indicated by the Storage Management Initiative Specification (SMI-S) which was developed by leading storage equipment and software providers.

Firmware and microcode upgrade or updates - The capabilities to perform firmware and microcode updates without interrupt to the operations of the SAN and hosts devices connected there to. This is to include, but not limited to, disk firmware, controller firmware, controller software, and internal SAN Fabric switches.

SAN boot support (minimum) - The ability to provide the operating system of a host server to boot directly from the SAN device without local server disks is required. Please see the Operating Systems as listed in VA Technical Reference Model.

Operating system compatibility (minimum) - Please see the Operating Systems as listed in VA Technical Reference Model (TRM). The current VA TRM will be provided by COTR during acquisition process

Applications compatibility (minimum) - Please see the Applications as listed in VA Technical Reference Model. The current VA TRM will be provided by COTR during acquisition process.

Redundant Array of Independent Disk (RAID) levels - Due to the varying needs and uses the SAN Solution will be required to support the capabilities of RAID1, RAID5 and RAID6 in the same storage subsystems and disk enclosure. While above is a minimum RAID levels additional RAID configuration support is desired.

RAID group size - The size limit for a RAID group must not exceed 7TB in order to obtain optimal performance. The size requirement for a RAID group is based on the ability to rebuild the RAID group following a disk failure. Based on a drive MTTF of 1,000,000 hours, a RAID-5 group larger than 7 TB has a high risk of not being able to successfully rebuild without an unrecoverable error (URE). The existence of 7 drives to a RAID set is optimal and is the recommend amount to be allocated to any given RAID drive set.

Power switches - In addition to being redundant all power switches and power plugs must be properly secured and encased to ensure that they cannot be accidentally tripped, unseated or create any situation where power will be disrupted to the devices they are providing power to.

Standardized layouts - The layout of the solution must be a consistent design that is in use at all datacenters that are keeping with VA standards. This approach allows for the redistribution of the equipment to different sites and the most efficient use of data center space.

Additional servers - SAN support is often managed via a dedicated server(s). These hosts must be supported by the same support contract and remote management. Additionally all host must adhere to all the VA security policies and procedures with relation to servers, must be FIPS140-2 compliant and have only VA approved software installed.

Role-based Access - The ability for the applicable support personnel to manage the SAN solution and support servers from an industry standard out of band management solution is required and critical. Due to the remote nature and decentralized nature of support personnel must be able to access the SAN and servers even while shutdown or during BIOS/POST operations.

Documentation - Documentation must be provided that is described in the standard that allows for the complete understanding of the solution that is implemented. The importance of this is to create a seamless handoff from the varying organizations that will be supporting the SAN solution

EVALUATION FACTORS

Lowest Total Cost of Ownership (TCO) solution that meets the performance requirements is preferred. Components considered are small footprint, power consumption, cooling, Hardware, Software, license, Overhead cost of managing the devices, Ease of Management, Acquisition cost, Maintenance and deployment costs, storage capacity (such as number of data copies),Information Lifecycle Management(ILM) cost.

Workload – The use of industry standard tools and benchmarks to provide adequate levels of validation during the acquisition process is critical to ensure the system procured can handle the rigors and high demands set forth in this tier.

Minimum IO/sec - The threshold of 20,000 IOPS using this SPC-1 benchmark has been identified as the minimum to provide the needs of the VistA application.

Minimum Throughput -The threshold of 1,000MBPS using this SPC-2 benchmark has been identified as the minimum to provide the needs of the VistA application.

Storage unit uptime – REQUIRED as defined in the standard above for this Tier. This would be 4 nines which equates to 52.6 minutes per year.

Redundancy – REQUIRED Redundant components are needed to ensure the failure of one component of the storage system will not cause an outage.

FC – Hosts to Storage Connectivity – REQUIRED 4/GB connections however 8/GB connections are highly desirable and requested.

iSCSI – Hosts to Storage Connectivity – REQUIRED with minimum current iSCSI capabilities of 1GB connectivity with 10GB preferred and or expandable to in future.

SCSI Initiators (host connections) – a SCSI initiator is the host-side endpoint of a SCSI session. Every redundant host connection requires two SCSI initiators. The greater the available space to be assigned (usable) the more initiators would be required. Suggest at least one SCSI initiator for every two drive slots or 256 minimum.

Replication – Storage subsystem must support asynchronous and synchronous HA and DR replication

LUN Creation – LUN creation is a must in the type of environment that this tiered solution will be placed.

LUN Expansion – REQUIRED

Storage provisioning – Function included in cost. Thin provisioning is typically a software function, but hardware must support it.

Tiering capability – Function included in cost. Thin provisioning is typically a software function, but hardware must support it. Array needs to support or include multiple drive types or if tiering will be between multiple storage subsystems of heterogeneous types.

Deduplication – Source, target, inline, or post process deduplication. The deduplication method used must not degrade overall application performance, storage performance, and will not reduce backup windows. Support Global deduplication is preferred.

Capable of perform both file-level, and block-level data deduplication is preferred.

Capable of perform both file-level and block-level data deduplication on primary storage is preferred.

Snapshots – Compare limits on number of snapshots that can be made of a primary storage LUN

Clones – Compare limits on number of snapshots that can be made of a primary storage LUN

Storage device scale up capability – REQUIRED Evaluate based on expandability of usable storage in TB

Supported Disk type - REQUIRED the supported disk type must be specified in all documentation as to the exact type, speed and capacity.

Return disk option - REQUIRED To be documented in the procurement that no failed disks will be returned to vendor or leave in the possession of the VA at all times until properly disposed.

Interoperability – Industry standards – REQUIRED the supporting documentation should be presented and validated during the acquisition process. These specifications are SMI-S v1.1 as described at: http://www.snia.org/forums/smi/tech_programs/smis_home/

Firmware and microcode upgrade or updates – REQUIRED the means at which the vendor's solution will accomplish this task needs to be documented and tested prior to acceptance of the solutions.

SAN boot support (minimum) - REQUIRED to support the operating systems listed are required within this document

Operating system compatibility (minimum) – At a minimum the supported solution will provide OS support for Windows based Operating System, Linux Based Operating System, UNIX based Operating System and OpenVMS Operating System. The current VA TRM will be provided by COTR during acquisition process.

Applications compatibility (minimum) – The current VA TRM will be provided by COTR during acquisition process.

Redundant Array of Independent Disk (RAID) levels should meet the current and future needs of the VA. While the current VistA "Production data" resides on mirrored RAID1 drives the ability to augment them with addition RAID types is important. Raid group sizing limitations of Terabytes and number of physical drives is needed and should be evaluated as part of the acquisition process.

RAID group size - The size limit for a RAID group must not exceed 7TB in order to obtain optimal performance. The total number of drives assigned to a particular RAID set must not exceed seven physical drives. This is to ensure the integrity of the RAID group.

Power switches - All power switches and power plugs must be properly secured and encased

Standardized layouts - Layout and plan design will need to be validated during the acquisition process

Additional servers - All additional servers should be identified during the procurement process and keep with the VA Server Standards.

Role-based Access - Refer to Server Standard, Section Class C Server

Documentation - Cost of documentation should be identified and included in the procurement process. Vendor shall provide electronic, three dimensional models of equipment proposed for use with CAD and visual design/planning applications.

IMPLEMENTATION GUIDANCE

Lowest Total Cost of Ownership (TCO) solution that meets the performance requirements is preferred.

Workload- The use of industry standard tools and benchmarks to provide adequate verifications levels during acceptance testing

Minimum IO/sec – Include validation in acceptance testing

Minimum Throughput – Include validation in acceptance testing

Storage Unit Uptime – Include validation in acceptance testing

Redundancy – Include validation in acceptance testing**.** Component failure testing should occur prior to putting into production. This should include a planned failure of a single component to ensure the backup/ secondary component provides adequate coverage to verify no outage of the storage system.

FC - Hosts to Storage Connectivity – Recommend 8/GB Fibre Channel connections to host.

iSCSI - Hosts to Storage Connectivity – Include validation in acceptance testing

iSCSI Initiator (Host Connections) - Include validation in acceptance testing

Replication – Testing of the replication process should occur during acceptance testing.

LUN Creation - Testing and actual creation for production should occur during acceptance testing to provide validation.

LUN Expansion – Include validation in acceptance testing

Storage Provisioning – Include validation in acceptance testing

Tiering Capability – If software is in place and capabilities exist the testing of this function should be conducted from this tier to a lower (or higher) tier.

Deduplication – Must test and validate to ensure the deduplication method used does not degrade overall application performance, storage performance, and will not reduce backup windows. Test and validate to ensure Global deduplication only process on copy of data among sites.

Snapshots – Include validation in acceptance testing

Clones – Include validation in acceptance testing

Supported Disk type - Fiber Channel and iSCSI are needed at a minimum.

Return disk option - Not applicable other than being aware of if any disk failure during implementation.

Interoperability – Industry standards - The standards which are provided in the sections above must be adhered to and validated during the implementation phase using the common set of tools identified in the SMI-S v1.1.

Firmware and microcode upgrade or updates - The means this is achieved by the SAN Solution needs to be tested.

SAN boot support (minimum) – Test and implement during installation with validation in acceptance testing

Operating system compatibility (minimum) - Include validation in acceptance testing

Applications compatibility (minimum) - Include validation in acceptance testing

Redundant Array of Independent Disk (RAID) levels - Include validation in acceptance testing

RAID group size - Include validation in acceptance testing

Power switches - All power switches and power plugs must be properly secured and encased. This also includes the proper covering of any emergency cutoff switches.

Standardized layouts - Ensure that all layouts conform to VA Standard and are validated during installation.

Additional servers - Operating System and Applications must be VA Server Standard. The current VA TRM will be provided by COTR during acquisition process. Refer to Server Standard, Section Class C Server

Role-Based Access – Described and documented in the support contract.

Documentation - All documentation should be in the form in a standard form that can be used by all VA support staff (i.e. Word documents, pdf or Visio).

3.3.2 [STORAGE MANAGEMENT SOFTWARE]

STANDARD

ID	*Secondary Attribute*	*Specification*
	Enterprise license not based on capacity	Software licenses provided must be perpetual with a five-year support and update subscription, with all licenses and rights transferred to the Government at the time the installation is completed. Licenses must be transferable without limitation and provisioned as a VA enterprise license, without additional storage allocation-based charges, such as per GB or TB.
	Interoperability	Management software must be listed as a Storage Networking Industry Association (SNIA) SMI-S 1.1 conforming client. (http://www.snia.org/forums/smi/tech_programs/ctp/smi_conform/smi_client/smi_client_definitions.
	Storage Reporting	Storage reporting components suitable for use in a fee for service, chargeback environment. Automated reports of storage allocations must be capable of being generated by non-IT staff. Must support ODBC and/or JDBC connectivity.
	Automated tools for LUN provisioning	The software should have automated tools to provision a large number of Disk Groups and LUNs. Similarly, an automated solution should be provided to configure hosts with large numbers of logical disks.
	Proactive monitoring and remote notification	The management tool must be capable of proactive monitoring and remote notification of system and application health. Must support ODBC and/or JDBC connectivity.
	Single storage management console	Storage hardware must be manageable from a single storage management application and with the capability of automatic discovery of equipment connected to the SAN.
	Additional servers	Refer to Server Standard, Section Class C Server
	Management server security	Refer to Server Standard, Section Class C Server
	Data snapshot (local)	License and annual maintenance (5 years) as required for software to support array-based point-in-time data images suitable for use for administrative tasks such as online backup & testing with no impact to source data and minimal additional space requirements.

	Performance analysis	Performance management software to monitor, analyze and report on all solution components (i.e. from host to fabric to storage). This includes storage subsystems, software operations, SAN infrastructure, replication and telecommunications. Software should be able to identify and analyze response time, and other relevant metrics to enable identification and resolution of potential bottlenecks. The tool must support OpenVMS client operating system. All management software must be ODBC and/or JDBC connectivity.
	Storage Capacity planning	The software must be able to analyze current capacity and forecasts future system requirements. The software should be able to collect component data to project future usage of the storage system.
	Local copy	License and annual maintenance (5 years) as required for software to support local array-array LUN copy/replication.
	Consistent design	All software should use identical components where possible to facilitate common updates across the solution.

EXPLANATION OF STANDARD

Enterprise license not based on capacity – to include 5 years of support as required for enterprise SAN Management application. Licenses must be transferable without limitation and provisioned as a VA enterprise license, without additional storage allocation-based charges, such as per GB or TB.

Interoperability - Management software must be listed as a Storage Networking Industry Association (SNIA) SMI-S 1.1 conforming client.
(http://www.snia.org/forums/smi/tech_programs/ctp/smi_conform/smi_client/smi_client_definitions

Storage Reporting – Access level reporting with the ability to generate reports by non-IT staff.

Automated tools for LUN provisioning - a single, intelligent interface that allows you to provision storage systems and fabric switches from end-to-end. The software should have automated tools to provision a large number of Disk Groups and LUNs along with the ability to configure hosts with large numbers of logical disks.

Proactive monitoring and remote notification - Storage Management software must be capable of monitoring and remote notification in the event of an alert, failure or the inability of the system to meet the customer's SLA's. Provisioning actions to trigger events, SNMP traps, and policies for notification. Ability to send email or custom scripts or programs for notification.

Single Storage Management console – Storage hardware must be manageable from a single storage management application.

Data snapshot (local) - License and annual maintenance (5 years) as required for software to support array-based point-in-time data images suitable for use for administrative tasks such as online backup & testing with no impact to source data and minimal additional space requirements.

Performance analysis – Storage management software to monitor, analyze and report on all solution components (i.e. from host to fabric to storage). This includes storage subsystems, software operations, SAN infrastructure, replication and telecommunications. Software should be able to identify and analyze response time, and other relevant metrics to enable identification and resolution of potential bottlenecks.

Storage Capacity planning - The software must be able to analyze current capacity and forecasts future system requirements. The software should be able to collect component data to project future usage of the storage system.

Local copy - License and annual maintenance (5 years) as required for software to support local array-array LUN copy/replication.

Consistent Design – All software should use identical components where possible to facilitate common updates across the solution.

EVALUATION FACTORS

- Enterprise Level Storage Management software
- Ability to manage multiple devices
- Enterprise License w/5years annual maintenance
- Storage Management Reporting
- Performance Monitoring
- Single Storage management console
- Ability to Manage events and policies

IMPLEMENTATION GUIDANCE

Implementation should include all optional software needed to meet the requirements listed above. Licensing and maintenance terms should the Hardware/Software Technical Support sections of this document. Professional implementation services should be included along with “classroom” training for support staff as outlined in the Training sections of this document.

3.3.3 [HARDWARE/SOFTWARE TECHNICAL SUPPORT]

STANDARD

ID	***Secondary Attribute***	***Specification***
	Support procedures	Documented support/escalation procedure for all components of the solution.
	Support Availability	Software support required 24x7x365 for all software provided in the solution. License and annual maintenance 3 years with 2 extension years.
		Hardware Maintenance/Support 5 yr, 24x7x365, 4 hour response time is required.
	License transfer	Licenses can be transferred without limitation within the Department of Veterans Affairs.
	OEM resources	Direct access to on-line OEM vendor support incident information and tracking.
	Support Interface	All VA datacenters must have access to incident information and tracking for all VA datacenters.
	Disruptive patches	Describe any type of updates/patch that would require a hosted service outage of the solution.
	SLAs	Documented Service Level Agreements (SLAs) for support requests.
	Professional services	Include cost of any professional services for services that must be completed by the vendor.

EXPLANATION OF STANDARD

Support procedures – A documented (digital & printed) set of instructions and escalation procedures to include updated contact information for the appropriate point of contact while troubleshooting problems. This will be a living document and as such digital copies should have supplements/replacements provided quarterly to ensure the most up to date procedures are available for the customer.

A concisely documented set of procedures is essential for communication between the customer and the support staff, allowing for all parties to know when priority escalation occurs, how it occurs, and the proper path for the expedited resolution.

Support Availability – Due to the criticality of these systems, full round the clock support is essential for a minimum of the first year, with options available to extend for the following four years allowing for a total of five years. In addition a minimal 4 hour response time in regards to hardware maintenance is required.

License transfer – All pertinent licenses must be capable of being transferred between various VA sites and cannot be restricted by location. Due to the nature of the OI&T structure for the VA licenses must be capable of being transferred within the various physical locations without restriction.

OEM resources – Direct communication paths to the knowledge experts of a product is key for fast response and ensuring the systems remain operational at the levels needed. Being required to go through middlemen in efforts to funnel trouble calls is not suitable to the nature of these systems.

Speaking directly with the product expert allows for potential miscommunication errors to be avoided. Being able to go directly to the appropriate level of tier knowledge on a failure is essential for ensuring that the problem is communicated correctly and quickly the best support engineer that can assist the customer.

Support interface – Due to many VA experts working across various regions and areas it is vital for all site's to be able to access VA wide information for troubleshooting and sharing of information.

VA I.T. support is organized through a central Office of Information Technology and is required to assist each various region/area as needed. Support contact and information should not be limited to a locality and must allow for access across the VA areas.

Disruptive patches – Ideally updates/patches will be able to be implemented with 0% system downtime. Any operations that would require a system outage needs to be documented and provided for review.

VA standards require that all disruptions be documented, submitted, and tracked to resolution. Known procedures that require disruption of service need to be documented and said documentation made available. Support engineers will need to work with VA staff to ensure that the required procedures for disruptions are followed.

SLAs - Documented Service Line Agreements (SLAs) for support request will be provided and the Vendor will ensure that there is no confusion between VA staff and Vendor on expectations.

Professional services – Provide a full disclosure of vendor specific services that must be provided by the vendor only. I.E. Some storage systems require a vendor engineer to flash firmware or similar upgrades and do not allow the customer to perform such actions.

VA standards require that outside contractors be escorted and/or evaluated for security requirements. All expected procedures that require vendor services need to be provided and a list of potential engineers that will be onsite updated as needed to ensure the engineer can gain access.

EVALUATION FACTORS

- Quality of documentation to include ease of finding information, extent of informative data, and usability in regards to trouble shooting and technical support will be considered.

- Direct phone contact for immediate escalation of troubleshooting over email, web interface, or other "automated" trouble shooting requests will be preferred.
- While direct access to product experts are needed, having a support engineer/contact to supervise and ensure that all experts are moving forward with the end goal of problem expedient problem resolution is preferred.
- Central/Single Interface for multiple sites to track VA related problems will be preferred.
- Minimum amount of scheduled downtime for patching/updating and supporting evidence for such is preferred.
- Path of communication for VA to suggest improvements and see improvements implemented is beneficial.
- Forums or other user group discussion areas are beneficial.
- Lower on-site response time is beneficial.
- Lower initial "engineer level" contact response time is beneficial.
- Lower time-to-repair is beneficial.
- Vendor-supplied components stocked as spares near, or at, facility is beneficial.
- Penalty clauses for vendor not meeting support contract provides is beneficial.

IMPLEMENTATION GUIDANCE

Coordination with initial VA staff for knowledge transfer and verified understanding is important. Continuing contact with VA staff to ensure support procedures are viable and procedures in place for VA input to improve support/product is essential.

3.3.4 [HARDWARE/SOFTWARE INSTALLATION]

STANDARD

ID	*Secondary Attribute*	*Specification*
	Installation	Provide hardware/software installation, including initial configuration, Storage Area Network configuration & knowledge transfer.
	Pre-configuration	Rack mount and configure the solution (including servers and storage where possible) prior to shipping it to the VA. This minimizes the on-site installation time as well as the number of crates and boxes that must be received and tracked by VA.
	Onsite impact	All on-site activities must be conducted in such a manner as to minimize the impact to normal information systems operations.
	Necessary software/hardware	Provide all necessary hardware and software, including all necessary cables and mounting hardware to make the Solution operational, except government-furnished property (GFP) referenced in GFP section.
	Delivery	Provide inside delivery, installation and insurance of all equipment to VA datacenters. The VA does not accept delivery of the equipment until acceptance testing is passed at all VA datacenters.
	Trash	Remove all trash associated with shipping, delivery and installation.
	OS installation and security	Refer to Server Standard, Section Class C Server

EXPLANATION OF STANDARD

Installation - Provide planning, configuration and tentative schedule for the initial installation. This planning should involve collaborating with customer technical personnel to insure any and all critical elements and requirements regarding the environment are communicated. This process is envisioned as a collaborative effort between the vendor and customer with the end result being an installation that is 100 percent complete, functional and fully documented and the customer understanding everything needed to operate and maintain the system. This also includes demonstrating the steps necessary to backup and restore the system to a fully functional state. This entire process is to be conducted in such a manner as to minimize the impact to normal information systems operation.

Pre-configuration - To shorten the installation process and better utilize the time vendor personnel are on-site it is required pre-racking and pre-configuring the solution as much as possible prior to delivery. This includes working with customer personnel to develop any custom software images and preload the images prior to shipping.

Restorable images – In addition to having hardware preloaded with software a process must be in place to have restorable images for these systems as a backup to needing to overwrite/restore an existing image during install. Custom DVD's, portable storage, etc… are all viable options to having the image onsite for quick access and use.

Onsite impact – Minimal impact on the site facility is required. Efforts will be taken by the Vendor to ensure that the prep, assembly, install, and testing of the Solution will be done in a professional manner with minimal impact upon local site. Concern in regards to trash, path blockage, unsecured equipment, excessive levels of noise, etc… should be considered and action taken accordingly.

Necessary software/hardware – Aside from government-furnished property (GFP) referenced in the GFP section, all software and hardware required to make the Solution operational will be provided by the Vendor. This is to include but not limited to: cables, mounting brackets, screws, install software, testing equipment, etc…

Delivery – The Vendor will take responsibility of ensuring that all materials are delivered into the facility install location and the materials will remain the responsibility of the Vendor until acceptance testing is passed at all VA datacenters.

Trash – The Vendor will take responsibility of the removal of all trash from the facility, including but not limited to: boxes, packing materials, plastic bags, ties, etc…

OS installation and security – Following existing documentation provide by the VA Platform Server Team ensure all Operating systems and Security applications are installed accordingly.

EVALUATION FACTORS

- It is considered beneficial if the vendor can detail a delivery, installation and configuration plan for the equipment the vendor is proposing.
- Any demonstration that equipment can be pre-racked, pre-configured or pre-imaged is considered beneficial
- Verification that images can be restored onsite instead of remotely for install purposes is preferred.
- A basic plan to show minimal impact during installation and setup with a certified technicians to follow this plan is preferred. Vendor hiring lowest cost "IT Talent" is not preferred.
- Checklists of hardware and software installation needs and verified availability of these is beneficial.

IMPLEMENTATION GUIDANCE

As much Vendor/VA staff preinstall communication to ensure full understanding is recommended.

Vendor verification of hardware fitting and requirements prior to install is required. Finding out at install that a piece of equipment does not fit or does not have all the install equipment is not acceptable.

All documentation, software, and hardware required for installation and operation of the Solution as well as training materials need to be onsite and verified for installation.

3.3.5 [TRAINING]

STANDARD

ID	*Secondary Attribute*	*Specification*
	Training Length	Provide equivalent of one hour of certified vendor classroom training for every TB of raw disk provided.
	Knowledge transfer	Work with VA staff as activities occur to ensure that VA can assume operational responsibility for the delivered solution.
	Documentation	Provide electronic copies of all materials, manuals, worksheets, etc. used in the delivery of the solution.

EXPLANATION OF STANDARD

Training Length – An initial complete training for VA staff is important for this project to succeed. An equivalent of one hour of certified vendor classroom training for every TB of raw disk provided, or more if the vendor believes this is needed.

VA support staff must have a level of trained knowledge provided to allow them to operate at a high level of expertise for day to day operations and standard problem resolution.

Knowledge transfer – While classroom training is important for the understanding of principles and procedures, actual knowledge transfer in regards to the implemented packages, how they work in the VA environment and potential improvement that may be available or upcoming is required.

Documentation – Initially all documentation for training, materials, worksheets, etc… for the initial installation must be provided in electronic format to ensure standard knowledge for all VA staff. As the product is changed and improved future training and documentation will also need to be provided.

Training documentation must be as complete as possible to allow for new VA staff to be able to understand and work with the vendor product.

EVALUATION FACTORS

- Vendor specific training that is oriented towards certification or “engineer” level training that is pertinent to properly managing and troubleshooting the product is preferred.
- Additional time/effort spent working with VA staff to ensure that the VA environment is optimized and meeting VA expectations is beneficial.
- When directly training VA staff printed as well as digital materials is beneficial to allow full potential of learning from staff.
- User forums for exchange of ideas and knowledge are preferred.

IMPLEMENTATION GUIDANCE

Any implementation that requires a strong base of knowledge for VA staff needs to have a planned training event set in place prior to installation to allow for full VA understanding and best potential for project implementation. While this training should be prior to installation it must not be so far in advance that newly learned skills/knowledge will become stale/obsolete by installation time.

In addition any installation that will occur near a time of a new patch or revision needs to ensure that the new knowledge is provided with the training.

3.4 [GENERAL STORAGE AREA NETWORK (SAN)]

3.4.1 [LAN CONNECTIVITY]

STANDARD

ID	*Secondary Attribute*	*Specification*
	IP Connectivity between Hosts and Storage device	Minimum 1 Gb Ethernet and 10 Gb Ethernet is preferred. Support Jumbo frame and LACP protocol.
		Support multi-pathing from Hosts and Storage devices.
		Storage Data connection should be logically separate from production LAN data connection.
		Primary storage data connection should be logically separate from replication data connection.

EXPLANATION OF STANDARD

IP Connectivity between Hosts and Storage device - Minimum 1 GB Ethernet and 10 GB Ethernet is preferred. Support Jumbo frame and (LACP) Link Aggregation Control Protocol. Link aggregation or IEEE802.1AX-2008 is a computer networking term which describes using multiple network cables/ports in parallel to increase the link speed beyond the limits of any one single cable or port, and to increase the redundancy for higher availability.

Local SAN fabric must be isolated from replication SAN fabric thru logical and physical zoning with intelligent network services which would support logically isolated path groupings.

EVALUATION FACTORS

-

IMPLEMENTATION GUIDANCE

3.4.2 [FABRIC SWITCH HARDWARE (HW)]

STANDARD

ID	*Secondary Attribute*	*Specification*
	Fabric Connectivity between Hosts and Storage device	Redundant Switch Control (Supervisor) Card
		Fiber Channel Protocol
		Minimum 4-Gbit/s Fiber Channel Ports
		All fiber Channel switch ports will be autosensing to 1, 2, 4 or 8Gb
	Interoperability	Compatible with equipment from Cisco, Brocade and Nortel hardware.
	Fabric Isolation	Local SAN fabric must be isolated from replication SAN fabric
	Capacity "Throughput"	Isolate data and devices within a fabric, and configurable throughput for specific applications. Supports at least 1 Tbps of internal bandwidth in a single chassis (switch enclosure).
	Capacity "Ports"	384 FC ports in a single chassis (switch enclosure). Able to provision additional SAN ports without interruption.
	Port virtualization	Support N Port Virtualization.
	Manageability	Manageable from a single application.
	Fully redundant configuration	Provide fully redundant configuration
	Oversubscription	Provide no more than 4:1 over subscription at 4 Gbps.
	Fabric	SAN switch shall support redundant fabrics.
	Automated monitoring	SAN switches must implement automated monitoring and phone-home support configurations over IP.
	Current generation equipment	Fiber channel switches and/or components must not be listed on vendor websites as "end of life" or "end of sale" or "end of service life". The initial hardware general availability date should be less than 5 years from the proposal submission date.
	Additional ports	Solution must provision additional SAN ports required to fully connect

		solution components (storage subsystems, inter-switch links, management hosts, replication hardware, etc) in addition to host requirements.
	Rack Configuration	Provide appropriate 4 posts (42 or 47 U) with sidewalls.
	Manageable power supplies	Redundant IP Manageable & Accessible Power Distribution Unit (PDUs) sufficient to power all units in the rack.
	Cooling	Fans (N+1) on switch and cabinet to support airflow requirements.
	Physical layout	All components must be easily accessible without having to de-install, disconnect or remove other components so that service can be easily accomplished.
	Standardized layouts	Components must be mounted in standardized configurations for all VA installations.
	Additional servers	Refer to Server Standard, Section Class C Server
	Role-based access	Solution must include security configurations that support role-based access required to limit functions during normal and COOP operation.

EXPLANATION OF STANDARD

Fabric Connectivity between Hosts and Storage device-Fiber Channel protocol widely used throughout the VA. Minimum of 4 GB Fiber Channel port speed, this is a mature & widely used technology. It is less expensive due to wide availability of this technology. This proven technology is stable and efficient throughout the Enterprise market. Supervisor Cards able to operate in either Active/Active or Active/Passive Mode. Ability to upgrade or replace any component without interruption during normal operation. Fiber Channel LC connector required.

Interoperability - Architecture of the Fabric switch should enable multilayer and multiprotocol functionality.

Fabric Isolation – Local SAN fabric must be isolated from replication SAN fabric (FCIP) thru logical and physical zoning with intelligent network services which would support logically isolated path groupings.

Capacity "Throughput" – Best Practice with "single initiator zones" is to create zones based on the initiator; each zone will contain a single Host, or initiator. Multiple storage array ports can be added to the zone without violating the single initiator rule-arrays are targets.

Capacity "Ports" – Switch enclosure to allow min. of 10 slots for port cards. Able to provision additional SAN ports without interruption Switch should support hardware based integrated port-level routing.

Port virtualization - Support N Port Virtualization with NPV or similar technology

Manageability - Manageable from a single application which can access to all components in the SAN fabric switches.

Fully redundant configuration – Ability of switch firmware or hardware to retain a copy of the current configuration and the previous configuration.

Oversubscription - allow over subscription depending on port activity.

Fabric – SAN Fabric switch, appropriate in a data center environment must be flexible and saleable. Ability to upgrade or replace any component without interruption during normal operation.

Automated Monitoring – SAN switches must implement automated monitoring and phone-home support configurations over IP. The ability to notify via multiple methods (example: email) any selected alerts that occur within the SAN fabric switches.

Current Generation Equipment - Fiber channel switches and/or components must not be listed on vendor websites as "End of Life" , "End of Sale" or "End of Service Life". The initial hardware general availability date should be less than 5 years from the proposal submission date.

Additional ports - Solution must be able to provision additional SAN ports without interruption. Support a verity of port types and capable of advanced traffic management.

Rack Configuration - Provide appropriate 4 posts (42 or 47 U) with sidewalls as specified by VA requirements.

Manageable Power Supplies – Ability to manage thru an API or other standard interface from a remote location all power metrics of the PDU's.

Cooling – Switch enclosure able to lose one fan without any impact to enclosure (N+1).

Physical Layout – All components must be easily accessible without having to de-install, disconnect or remove other components so that service can be easily accomplished. This requires that all components within the SAN fabric switches be able to be replaced or upgraded without removing another component, this includes not blocking or restricting access to another component via cables or brackets.

Standardized layouts - The layout of the solution must be a consistent design that is in use at all datacenters that are keeping with VA standards. This approach allows for the redistribution of the equipment to different sites and the most efficient use of data center space.

Additional Servers – Refer to Server Standards, Section Class C Server

Role-Based Access - Solution must include security configurations that support role-based access required to limit functions during normal and COOP operation. This role-based access should be granular and meet all VA security requirements.

EVALUATION FACTORS

- Lowest Total Cost of Ownership (TCO) solution that meets the performance requirements is preferred. Components considered are small footprint, power consumption, cooling, Hardware, Software, license, Overhead cost of managing the devices, Ease of Management, Acquisition cost, Maintenance and deployment costs.
- Support for FCoE protocol is highly desirable.
- Support for iSCSI protocol is highly desirable.

- Support for FICON connectivity is highly desirable.

IMPLEMENTATION GUIDANCE

Lowest Total Cost of Ownership (TCO) solution that meets the performance requirements is preferred.

Fabric and Topology, Vista requires up to 10 logically isolated path groups in a SAN fabric to be shared between its two metro data centers, this allows this application the ability to meet its redundancy and availability requirements.

Synchronous replication over FCIP between Metro Data centers for HA, which is widely used in VA Vista application.

Oversubscription **-** no more than 4:1 over subscription with 4 GBs ports in a SAN fabric used with the Vista application.

3.4.3 [SAN MANAGEMENT SOFTWARE]

STANDARD

ID	*Secondary Attribute*	*Specification*
	Management Software	Enterprise level SAN management software Automatic configuration checking for SAN configuration, updates and reconfigurations. Automatic discover of equipment connected to the SAN Manage multiple devices in a selected domain. Wizards for common tasks such as zone configuration, , Fiber Channel over IP (FCIP) tunnels, and access control lists (ACLs) Fabric Interoperability – work with SAN switches regardless of vendor Must support ODBD and JDBC connectivity
	Interoperability	Management software must be listed as a Storage Networking Industry Association (SNIA) SMI-S 1.1 conforming client. (http://www.snia.org/forums/smi/tech_programs/ctp/smi_conform/smi_client/smi_client_definitions.
	SAN Reporting	SAN reporting components suitable for use in an enterprise environment. Automated reports of storage allocations must be capable of being generated by non-IT staff. Must support ODBC and/or JDBC connectivity.
	Proactive monitoring and remote notification	The management tool must be capable of proactive monitoring and remote notification of system and application health. Must support ODBC and/or JDBC connectivity.
	Performance monitoring	Performance statistics for Inter-Switch Links (ISLs), host and storage device connections, and traffic between specific Fiber Channel sources and destinations (flows) Ability to set performance threshold based on manual entry or calculated based on previous measurements. Historical performance reports and graphs over daily, weekly, monthly, and yearly intervals; Top 10 and daily summary reports for all ISLs, hosts, storage connections, and flows.

		Performance reports should be accessible without privileged access to the SAN switch.
	Single SAN management console	SAN hardware must be manageable from a single storage management application and with the capability of automatic discovery of equipment connected to the SAN.
	Additional servers	Refer to Server Standard, Section Class C Server
	Management server security	Refer to Server Standard, Section Class C Server
	Consistent design	All software should use identical components where possible to facilitate common updates across the solution.

EXPLANATION OF STANDARD

Management Software – Must have Enterprise level management for heterogeneous, physical and virtual host Infrastructure. Automatic configuration checking for SAN configuration, updates and reconfigurations. Automatic discovery of SAN attached equipment. Must support various fabric switches regardless of vendor.

Interoperability - Management software must be listed as a Storage Networking Industry Association (SNIA) SMI-S 1.1 conforming client.
(http://www.snia.org/forums/smi/tech_programs/ctp/smi_conform/smi_client/smi_client_definitions

SAN Reporting - Automated reports of storage allocations must be capable of being generated by non-IT staff.

Proactive monitoring and remote notification - SAN Management software must be capable of monitoring and remote notification in the event of an alert, failure or the inability of the system to meet the customer's SLA's. Provisioning actions are required to trigger events, SNMP traps, and policies for notification. Must have the ability to send email, run customized scripts or programs for notifications.

Performance monitoring - Storage management software to monitor, analyze and report on all solution components (i.e. from host to fabric to storage). This includes storage subsystems, software operations, SAN infrastructure, replication and telecommunications. Software should be able to identify and analyze response time, and other relevant metrics to enable identification and resolution of potential bottlenecks.

Single SAN management console - Storage hardware must be manageable from a single storage management application.

Consistent design - All software should use identical components where possible to facilitate common updates across the solution.

EVALUATION FACTORS

- Enterprise Level Storage Management software
- Ability to manage multiple devices
- Enterprise License w/5years annual maintenance
- Storage Management Reporting
- Performance Monitoring
- Single Storage management console
- Ability to Manage events and policies

IMPLEMENTATION GUIDANCE

Implementation should include all optional software needed to meet the requirements listed above. Licensing and maintenance terms should the Hardware/Software Technical Support sections of this document. Professional implementation services should be included along with “classroom” training for support staff as outlined in the Training sections of this document.

3.4.4 [HARDWARE/SOFTWARE TECHNICAL SUPPORT]

STANDARD

ID	***Secondary Attribute***	***Specification***
	Support procedures	Documented support/escalation procedure for all components of the solution.
	Support Availability	Software support required 24x7x365 for all software provided in the solution. License and annual maintenance 3 years with 2 extension years.
		Hardware Maintenance/Support 5 yr, 24x7x365, 4 hour response time is required.
	License transfer	Licenses can be transferred without limitation within the Department of Veterans Affairs.
	OEM resources	Direct access to on-line OEM vendor support incident information and tracking.
	Support Interface	All VA datacenters must have access to incident information and tracking for all VA datacenters.
	Disruptive patches	Describe any type of updates/patch that would require a hosted service outage of the solution.
	SLAs	Documented Service Level Agreements (SLAs) for support requests.
	Professional services	Include cost of any professional services for services that must be completed by the vendor.

EXPLANATION OF STANDARD

Support procedures – A documented (digital & printed) set of instructions and escalation procedures to include updated contact information for the appropriate point of contact while troubleshooting problems. This will be a living document and as such digital copies should have supplements/replacements provided quarterly to ensure the most up to date procedures are available for the customer.

A concisely documented set of procedures is essential for communication between the customer and the support staff, allowing for all parties to know when priority escalation occurs, how it occurs, and the proper path for the expedited resolution.

Support Availability – Due to the criticality of these systems, full round the clock support is essential for a minimum of the first year, with options available to extend for the following four years allowing for a total of five years. In addition a minimal 4 hour response time in regards to hardware maintenance is required.

License transfer – All pertinent licenses must be capable of being transferred between various VA sites and cannot be restricted by location. Due to the nature of the OI&T structure for the VA licenses must be capable of being transferred within the various physical locations without restriction.

OEM resources – Direct communication paths to the knowledge experts of a product is key for fast response and ensuring the systems remain operational at the levels needed. Being required to go through middlemen in efforts to funnel trouble calls is not suitable to the nature of these systems.

Speaking directly with the product expert allows for potential miscommunication errors to be avoided. Being able to go directly to the appropriate level of tier knowledge on a failure is essential for ensuring that the problem is communicated correctly and quickly the best support engineer that can assist the customer.

Support interface – Due to many VA experts working across various regions and areas it is vital for all site's to be able to access VA wide information for troubleshooting and sharing of information.

VA I.T. support is organized through a central Office of Information Technology and is required to assist each various region/area as needed. Support contact and information should not be limited to a locality and must allow for access across the VA areas.

Disruptive patches – Ideally updates/patches will be able to be implemented with 0% system downtime. Any operations that would require a system outage needs to be documented and provided for review.

VA standards require that all disruptions be documented, submitted, and tracked to resolution. Known procedures that require disruption of service need to be documented and said documentation made available. Support engineers will need to work with VA staff to ensure that the required procedures for disruptions are followed.

SLAs - Documented Service Line Agreements (SLAs) for support request will be provided and the Vendor will ensure that there is no confusion between VA staff and Vendor on expectations.

Professional services – Provide a full disclosure of vendor specific services that must be provided by the vendor only. I.E. Some storage systems require a vendor engineer to flash firmware or similar upgrades and do not allow the customer to perform such actions.

VA standards require that outside contractors be escorted and/or evaluated for security requirements. All expected procedures that require vendor services need to be provided and a list of potential engineers that will be onsite updated as needed to ensure the engineer can gain access.

EVALUATION FACTORS

- Quality of documentation to include ease of finding information, extent of informative data, and usability in regards to trouble shooting and technical support will be considered.

- Direct phone contact for immediate escalation of troubleshooting over email, web interface, or other "automated" trouble shooting requests will be preferred.
- While direct access to product experts are needed, having a support engineer/contact to supervise and ensure that all experts are moving forward with the end goal of problem expedient problem resolution is preferred.
- Central/Single Interface for multiple sites to track VA related problems will be preferred.
- Minimum amount of scheduled downtime for patching/updating and supporting evidence for such is preferred.
- Path of communication for VA to suggest improvements and see improvements implemented is beneficial.
- Forums or other user group discussion areas are beneficial.
- Lower on-site response time is beneficial.
- Lower initial "engineer level" contact response time is beneficial.
- Lower time-to-repair is beneficial.
- Vendor-supplied components stocked as spares near, or at, facility is beneficial.
- Penalty clauses for vendor not meeting support contract provides is beneficial.

IMPLEMENTATION GUIDANCE

Coordination with initial VA staff for knowledge transfer and verified understanding is important. Continuing contact with VA staff to ensure support procedures are viable and procedures in place for VA input to improve support/product is essential.

3.4.5 [HARDWARE/SOFTWARE INSTALLATION]

STANDARD

ID	***Secondary Attribute***	***Specification***
	Installation	Provide hardware/software installation, including initial configuration, Storage Area Network configuration & knowledge transfer.
	Pre-configuration	Rack mount and configure the solution (including servers and storage where possible) prior to shipping it to the VA. This minimizes the on-site installation time as well as the number of crates and boxes that must be received and tracked by VA.
	Onsite impact	All on-site activities must be conducted in such a manner as to minimize the impact to normal information systems operations.
	Necessary software/hardware	Provide all necessary hardware and software, including all necessary cables and mounting hardware to make the Solution operational, except government-furnished property (GFP) referenced in GFP section.
	Necessary software/hardware	Provide inside delivery, installation and insurance of all equipment to VA datacenters. The VA does not accept delivery of the equipment until acceptance testing is passed at all VA datacenters.
	Trash	Remove all trash associated with shipping, delivery and installation.
	OS installation and security	Refer to Server Standard, Section Class C Server
	Single-initiator zoning	Hosts shall be connected using single-initiator zoning configuration.

EXPLANATION OF STANDARD

Installation - Provide planning, configuration and tentative schedule for the initial installation. This planning should involve collaborating with customer technical personnel to insure any and all critical elements and requirements regarding the environment are communicated. This process is envisioned as a collaborative effort between the vendor and customer with the end result being an installation that is 100 percent complete, functional and fully documented and the customer understanding everything needed to operate and maintain the system. This also includes demonstrating the steps necessary to backup and restore the system to a fully functional state. This entire process is to be conducted in such a manner as to minimize the impact to normal information systems operation.

Pre-configuration - To shorten the installation process and better utilize the time vendor personnel are on-site it is required pre-racking and pre-configuring the solution as much as possible prior to delivery. This includes working with customer personnel to develop any custom software images and preload the images prior to shipping.

Restorable images – In addition to having hardware preloaded with software a process must be in place to have restorable images for these systems as a backup to needing to overwrite/restore an existing image during install. Custom DVD's, portable storage, etc… are all viable options to having the image onsite for quick access and use.

Onsite impact – Minimal impact on the site facility is required. Efforts will be taken by the Vendor to ensure that the prep, assembly, install, and testing of the Solution will be done in a professional manner with minimal impact upon local site. Concern in regards to trash, path blockage, unsecured equipment, excessive levels of noise, etc… should be considered and action taken accordingly.

Necessary software/hardware – Aside from government-furnished property (GFP) referenced in the GFP section, all software and hardware required to make the Solution operational will be provided by the Vendor. This is to include but not limited to: cables, mounting brackets, screws, install software, testing equipment, etc…

Delivery – The Vendor will take responsibility of ensuring that all materials are delivered into the facility install location and the materials will remain the responsibility of the Vendor until acceptance testing is passed at all VA datacenters.

Trash – The Vendor will take responsibility of the removal of all trash from the facility, including but not limited to: boxes, packing materials, plastic bags, ties, etc…

OS installation and security – Following existing documentation provide by the VA Platform Server Team ensure all Operating systems and Security applications are installed accordingly.

Single-initiator Zoning – Best practices follow a Single-initiator zoning plan, keeping each host separate and easily managed as such. The solution needs to not only be capable of supporting Single-initiator zoning but restrictions on the number of zones should be minimal.

The reason is to avoid SCSI interrupt affecting from one host to another host. It is to isolate each device so that they do not affect each other.

EVALUATION FACTORS

- It is considered beneficial if the vendor can detail a delivery, installation and configuration plan for the equipment the vendor is proposing.
- Any demonstration that equipment can be pre-racked, pre-configured or pre-imaged is considered beneficial
- Verification that images can be restored onsite instead of remotely for install purposes is preferred.
- A basic plan to show minimal impact during installation and setup with a certified technicians to follow this plan is preferred. Vendor hiring lowest cost "IT Talent" is not preferred.
- Checklists of hardware and software installation needs and verified availability of these is beneficial.

IMPLEMENTATION GUIDANCE

As much Vendor/VA staff preinstall communication to ensure full understanding is recommended.

Vendor verification of hardware fitting and requirements prior to install is required. Finding out at install that a piece of equipment does not fit or does not have all the install equipment is not acceptable.

All documentation, software, and hardware required for installation and operation of the Solution as well as training materials need to be onsite and verified for installation.

3.4.6 [TRAINING]

STANDARD

ID	*Secondary Attribute*	*Specification*
	Training Length	Provide equivalent of one day of certified vendor classroom training for every 24 fiber channel ports provided.
	Knowledge transfer	Work with VA staff as activities occur to ensure that VA can assume operational responsibility for the delivered solution.
	Documentation	Provide electronic copies of all materials, manuals, worksheets, etc. used in the delivery of the solution.

EXPLANATION OF STANDARD

Training Length – An initial complete training for VA staff is important for this project to succeed. An equivalent of one day of certified vendor classroom training for every 24 fiber channel ports, or more if the vendor believes this is needed.

VA support staff must have a level of trained knowledge provided to allow them to operate at a high level of expertise for day to day operations and standard problem resolution.

Knowledge transfer – While classroom training is important for the understanding of principles and procedures, actual knowledge transfer in regards to the implemented packages, how they work in the VA environment and potential improvement that may be available or upcoming is required.

Documentation – Initially all documentation for training, materials, worksheets, etc… for the initial installation must be provided in electronic format to ensure standard knowledge for all VA staff. As the product is changed and improved future training and documentation will also need to be provided.

Training documentation must be as complete as possible to allow for new VA staff to be able to understand and work with the vendor product.

EVALUATION FACTORS

- Vendor specific training that is oriented towards certification or “engineer” level training that is pertinent to properly managing and troubleshooting the product is preferred.
- Additional time/effort spent working with VA staff to ensure that the VA environment is optimized and meeting VA expectations is beneficial.
- When directly training VA staff printed as well as digital materials is beneficial to allow full potential of learning from staff.
- User forums for exchange of ideas and knowledge are preferred.

IMPLEMENTATION GUIDANCE

Any implementation that requires a strong base of knowledge for VA staff needs to have a planned training event set in place prior to installation to allow for full VA understanding and best potential for project implementation. While this training should be prior to installation it must not be so far in advance that newly learned skills/knowledge will become stale/obsolete by installation time.

In addition any installation that will occur near a time of a new patch or revision needs to ensure that the new knowledge is provided with the training.

3.5 [GENERAL BACKUP AND ARCHIVE STANDARD]

3.5.1 [BACKUP METHOD]

STANDARD

ID	*Secondary Attribute*	*Specification*
	Tape	Direct tape backup from Primary storage
		Snapshot from Primary disk to secondary disk and backup to tape. Offload backup resources from primary storage device to secondary storage device (VTL or disk) is preferred
	Disk (Tapeless)	Backup from Primary disk to secondary disk such as Virtual tape library (VTL) with deduplication solution that meets all other backup requirements including retention and offsite storage policy
		Continuous Data Protection (CDP) is preferred for stringent SLA, RPO, and RTO requirements and the ability to recover ANY point in time
		Support Asynchronous replication with deduplicated data is preferred.
	Archive	Long term Data Archiving solution must meet OGC VA Litigation, State, and Federal requirements
		For data not access frequently

EXPLANATION OF STANDARD

TAPE

- Direct tape backup from Primary Storage – The ability to utilize direct tape backup from primary storage is for compliance with government regulations which requires full monthly data backup to an offsite tape location.

- Snapshot from Primary Disk to secondary disk and backup to tape. Offload backup resources from primary storage device to secondary storage device (VTL or disk) is preferred. - Due to the compliance with government regulation which include; Sarbanes-Oxley Act (2002) intended to "deter and punish corporate and accounting fraud and corruption, ensure justice for wrongdoers, and protect the interest of workers and shareholders" (President Bush), USA Patriot Act passed in September of 2001 which introduced a plethora of legislative changes that significantly increased the surveillance and investigative powers of law enforcements agencies in the US., and the Health Insurance Portability and Accountability Act (HIPPA) of 1996 involves legislation protecting patient privacy and records security – organizations are required to store, manage, and safeguard a lot more data. This has lead to the need for more storage capacity and more efficient methods of backing up, retrieving, and archiving data. Snapshot from Primary Disk to secondary disk and backup to tape is one way to

effectively accomplish a proper protection and recovery strategy of large data sets and still meet the tape backup compliance required by government regulations. This method offloads backup process from primary storage to secondary storage to allow wider backup windows that are not restricted by the production hours.

Disk (Tapeless)

- Backup from Primary disk to secondary disk such as Virtual tape library (VTL) with deduplication solution that meets all other backup requirements including retention and offsite storage policy. – Disk based backup is a solution to effectively meet the backup window requirements of the data center. The backups are faster, restores are more reliable. If you incorporate a VTL into the environment, you can reference physical disk as a VTL allowing the backup software to see the VTL as a tape drive. You can also include data deduplication technologies. Data deduplication systems employ a data reduction technique that identifies common "chunks" of bytes among multiple data files, and only stores these chunks once. Using this method allows you to store data in less disk space.

- Continuous Data Protection (CDP) is preferred for stringent SLA, RPO, and RTO requirements and the ability to recover ANY point in time. – Continuous Data Protection (also known as synchronous replication) is a backup and recovery solution that continuously backs up data as it changes to ensure recovery of a current version within minutes of a failure. The data is always current between the sites but is a more expensive solution than asynchronous.

- Support Asynchronous replication with deduplicated data is preferred. - With asynchronous replication, there is a delay before the data gets written to the secondary site. Because asynchronous replication is designed to work over distances and requires less bandwidth, it is often a better option for disaster recovery. However, asynchronous replication risks a loss of data during a system outage because data at the target device is not up to date with the source data. Data deduplication is often combined with replication for disaster recovery purposes. Deduplication reduces the amount of data that gets replicated and lowers the bandwidth requirement to copy data to secondary site.

Archive

- Long term Data Archiving solution must meet with OGC VA Litigation, State, and Federal requirements. – Federal and state laws, including Health Insurance Portability and Accountability Act (HIPAA) regulations, require covered entities to store certain data, such as the final, consolidated, electronic version of a Patient Medical Record, for up to 75 years after the last episode of patient care. More information can be found in the website http://vista.med.va.gov/iss/ . In addition, long term Data Archiving solution is needed based on the guidelines Litigation Hold Memo Appendix A 6-30-08.pdf dated 6-30-2008 referenced on the Office of General Counsel – OGC VA Litigation website, http://vaww.client.gc.va.gov/General/Litigation/vcs/index.htm .

- For data not access frequently – When infrequently accessed files are stored, they consume ever increasing amounts of storage space and cause daily backups to increase. Data Archiving moves the files from expensive disk storage to less expensive media, but allows information to be always available. For business, legal, and regulatory requirements, the data must be available for many years or even decades.

EVALUATION FACTORS

- Lowest Total Cost of Ownership (TCO) solution that meets the performance requirements is preferred. Components considered are small footprint, power consumption, cooling, Hardware, Software, license, Overhead cost of managing the devices, Ease of Management, Acquisition cost, Maintenance and deployment costs, storage capacity (such as number of data copies),Information Lifecycle Management(ILM) cost.
- Disk (Tapeless)/Archive – It is beneficial to be able to have VTL and Archive storage resides in one storage device.
- Avoid products with proprietary Application Programming Interface (API) that only allow its product to store or recover data.

IMPLEMENTATION GUIDANCE

Lowest Total Cost of Ownership (TCO) solution that meets the performance requirements is preferred.

Create snapshots or clones to secondary disks are recommended.

Offload direct tape backup process from primary disks is recommended as it will have less impact to production performance and eliminates the backup window restriction.

Ensure solution has alternate way to store and retrieve data locally or remotely.

Implement Asynchronous replication with deduplicated data. Global deduplication among multiple devices is recommended.

3.5.2 [VIRTUAL TAPE LIBRARY (VTL) HARDWARE]

STANDARD

ID	*Secondary Attribute*	*Specification*
	Technology	Support Massive Array of Idle Disks (MAID)
	Disk health monitoring	Capable of pro-actively disks monitoring and detecting potential drive failures before it occurs.
	Deduplication	Minimum of supporting post process data deduplication.
	Replication	Support Asynchronous replication with deduplicated data
	Raw Storage Capacity	Up to 896 TB per cabinet
	Number of Emulated Tape Libraries	1 to 8
	Number of Emulated Tape Drives	1 to 28 standard (1-512 with HPCM option)
	Number of Virtual Tape Cartridges	Up to 8192
	Connectivity	Minimum four FC connectivity of 4 GigE ports per system.
	Redundancy	Redundant fan, N+1 Redundancy, Hot-Swappable Power Supplies

EXPLANATION OF STANDARD

Technology – MAID (massive array of idle disks) is a storage technology that employs a large group of disk drives in which only those drives in active use are spinning at any given time. This reduces power consumption and prolongs the life of the drives. MAID is designed for Write Once Read Occasionally (WORO) applications. The disk spin down feature of the MAID technology allows cost savings from bulk purchase of disks in the initial procurement. Disks that are not used are spin down that save energy cost and disk access life; and only spin up when it is used.

Disk health monitoring - Capable of pro-actively monitor the health of disks by performing integrity checks on all disks. Capable of copy data from a potentially failing disk to a new healthy spare disk, avoiding lengthy RAID rebuild times and data loss.

Deduplication – Data Deduplication is a technology strives to reduce the amount of duplicate data being backed up and then stored. The technologies identify and eliminate common data in and across backup streams. By eliminating the common objects, the resulting storage requirement will be reduced.

Global deduplication comes into play when you have multiple deduplication devices. With multiple deduplication devices nodes, when data that is seen before by one node is sent to a second node, the second node knows that data has already been stored and it will not be stored for a second time.

Replication - Replication is typically a software function, but hardware must support replication.

Raw Storage Capacity – Specification from market research needed for Enterprise Class Data Center environment.

Number of Emulated Tape Libraries – Specification from market research needed for Enterprise Class Data Center environment.

Number of Emulated Tape Drives – Specification from market research needed for Enterprise Class Data Center environment.

Number of Virtual Tape Cartridges – Specification from market research needed for Enterprise Class Data Center environment.

Connectivity – Storage subsystem must have multiple 4 Gb/second connectivity. An 8/GB connection is highly desirable.

Redundancy – Failure of a single component will not stop storage system operation in any capacity. Fully redundant storage systems are critical to the continuing processing and to maintain system stability.

EVALUATION FACTORS

- Lowest Total Cost of Ownership (TCO) solution that meets the performance requirements is preferred. Components considered are small footprint, power consumption, cooling, Hardware, Software, license, Overhead cost of managing the devices, Ease of Management, Acquisition cost, Maintenance and deployment costs, storage capacity (such as number of data copies),Information Lifecycle Management(ILM) cost.
- Redundant components are needed to ensure the failure of one component of the storage system will not cause an outage.
- Using the same replication software for Primary storage and all other storage is beneficial.
- It is beneficial to be able to have VTL and Archive storage resides in one storage device.
- Deduplication – Source, target, inline, or post process deduplication. The deduplication method used must not degrade overall application performance, storage performance, and will not reduce backup windows. Support Global deduplication is preferred.
- Capable of perform both file-level, and block-level data deduplication is preferred.
- Capable of perform both file-level and block-level data deduplication on primary storage is preferred.
- Avoid products with proprietary Application Programming Interface (API) that only allow its product to store or recover data.

IMPLEMENTATION GUIDANCE

Lowest Total Cost of Ownership (TCO) solution that meets the performance requirements is preferred.

Offload direct tape backup process from primary disks is recommended as it will have less impact to production performance and eliminates the backup window restriction.

Ensure solution has alternate way to store and retrieve data locally or remotely.

Redundancy **–** Include validation in acceptance testing**.** Component failure testing should occur prior to putting into production. This should include a planned failure of a single component to ensure the backup/ secondary component provides adequate coverage to verify no outage of the storage system.

Deduplication – Must test and validate to ensure the deduplication method used does not degrade overall application performance, storage performance, and will not reduce backup windows. Test and validate to ensure Global deduplication only process one copy of data among sites.

Implement Asynchronous replication with deduplicated data. Global deduplication among multiple devices is recommended.

3.5.3 [ARCHIVE HARDWARE]

STANDARD

ID	*Secondary Attribute*	*Specification*
	Technology	Support Massive Array of Idle Disks (MAID)
	Disk health monitoring	Capable of pro-actively disks monitoring and detecting potential drive failures before it occurs.
	Data Storage Architecture	Support write-once-read-many (WORM) and Write Once Read Occasionally (WORO)
	Deduplication	Minimum of supporting post process deduplication.
	Replication	Support Asynchronous replication with deduplicated data
	Protocol Support	CIFS,NFS V2 + V3, TCP/IP
	Number of Files	Up to 1.5 Billion files
	File Size	Up to 1.2TB file size
	Raw Storage Capacity	Up to 896 TB per cabinet
	Number of drives	Single Cabinet Up to 896 drives
	Connectivity	Minimum four FC connectivity of 4 GigE ports per system
	Redundancy	Redundant fan, N+1 Redundancy, Hot-Swappable Power Supplies

EXPLANATION OF STANDARD

Technology – MAID (massive array of idle disks) is a storage technology that employs a large group of disk drives in which only those drives in active use are spinning at any given time. This reduces power consumption and prolongs the life of the drives. MAID is designed for Write Once Read Occasionally (WORO) applications. The disk spin down feature of the MAID technology allows cost savings from bulk purchase of disks in the initial procurement. Disks that are not used are spin down that save energy cost and disk access life; and only spin up when it is used.

Disk health monitoring - Capable of pro-actively monitor the health of disks by performing integrity checks on all disks. Capable of copy data from a potentially failing disk to a new healthy spare disk, avoiding lengthy RAID rebuild times and data loss.

Data Storage Architecture – In order to reduces power consumption and prolongs the life of the drives. The system is capable of supporting Write Once Read Occasionally (WORO). For security application, the system is capable of supporting Write Once Read Many (WORM) storage Data Storage Architecture.

Deduplication – Data Deduplication is a technology strives to reduce the amount of duplicate data being backed up and then stored. The technologies identify and eliminate common data in and across backup streams. By eliminating the common objects, the resulting storage requirement will be reduced.

Global deduplication comes into play when you have multiple deduplication devices. With multiple deduplication devices nodes, when data that is seen before by one node is sent to a second node, the second node knows that data has already been stored and it will not be stored for a second time.

Protocol Support - Product that supports common protocol like NSF and CIFS is required. Avoid product with proprietary Application Programming Interface (API) that only allow its product to store or recover data.

Replication - Replication is typically a software function, but hardware must support replication Protocol Support.

Number of Files - Specification from market research needed for Enterprise Class Data Center environment.

File Size - Specification from market research needed for Enterprise Class Data Center environment.

Raw Storage Capacity - Specification from market research needed for Enterprise Class Data Center environment.

Number of drives - Specification from market research needed for Enterprise Class Data Center environment.

Connectivity – Storage subsystem must have multiple 4 Gb/second connectivity. An 8/GB connection is highly desirable.

Redundancy – Failure of a single component will not stop storage system operation in any capacity. Fully redundant storage systems are critical to the continuing processing and to maintain system stability.

EVALUATION FACTORS

- Lowest Total Cost of Ownership (TCO) solution that meets the performance requirements is preferred. Components considered are small footprint, power consumption, cooling, Hardware, Software, license, Overhead cost of managing the devices, Ease of Management, Acquisition cost, Maintenance and deployment costs, storage capacity (such as number of data copies),Information Lifecycle Management(ILM) cost.
- Redundant components are needed to ensure the failure of one component of the storage system will not cause an outage.
- Using the same replication software for Primary storage and all other storage is beneficial.
- It is beneficial to be able to have VTL and Archive storage resides in one storage device.
- Deduplication – Source, target, inline, or post process deduplication. The deduplication method used must not degrade overall application performance, storage performance, and will not reduce backup windows. Support Global deduplication is preferred.
- Capable of perform both file-level, and block-level data deduplication is preferred.
- Capable of perform both file-level and block-level data deduplication on primary storage is preferred.
- Avoid products with proprietary Application Programming Interface (API) that only allow its product to store or recover data.

IMPLEMENTATION GUIDANCE

Lowest Total Cost of Ownership (TCO) solution that meets the performance requirements is preferred.

Ensure solution has alternate way to store and retrieve data locally or remotely.

Redundancy **–** Include validation in acceptance testing**.** Component failure testing should occur prior to putting into production. This should include a planned failure of a single component to ensure the backup/ secondary component provides adequate coverage to verify no outage of the storage system.

Deduplication – Must test and validate to ensure the deduplication method used does not degrade overall application performance, storage performance, and will not reduce backup windows. Test and validate to ensure Global deduplication only process on copy of data among sites.

Implement Asynchronous replication with deduplicated data. Global deduplication among multiple devices is recommended.

3.5.4 [TAPE LIBRARY HARDWARE]

STANDARD

ID	*Secondary Attribute*	*Specification*
	Interoperability - Industry standards	Tape Library must provide for tape drives with minimum 800 GB uncompressed and throughput minimum of 120 MB/sec. Tape Library drives must be capable of encryption with minimum 1TB tape capacity and throughput minimum of 120 MB/sec. (FIPS 140-2, Level 3)
	Compatibility	Tape library must be capable of reading previously written tapes in the following formats: DLT and LTO.
	Backup SAN	Solution must provision SAN/network components as required to meet performance requirements and isolate backup traffic from normal production traffic.
	Connectivity	Fiber Channel, FICON, ESCON
	Fully redundant configuration	Provide fully redundant configuration such as ports, robots, tape drives, power supplies.
	Current generation equipment	Tape libraries and/or components must not be listed on vendor websites as “end of life” or “end of sale”. The initial hardware general availability date should be less than 5 years from the proposal submission date.
	Library Capacity (throughput)	Minimum throughput of 16 TB per hour
	Capacity (slots)	Solution must provide a minimum of 500 active tape slots
	Scalability (throughput)	Minimum scalability of 20 TB per hour
	Scalability (slots)	Solution must provide the ability to expand to 100% of minimum number of tape slots.
	Rack Configuration	Provide appropriate 4 posts (42 or 47 U) with sidewalls.
	Manageable power supplies	Redundant IP Manageable & Accessible Power Distribution Unit (PDUs) sufficient to power all units in the rack.

	Cooling	N + 1 Fans to support airflow requirements.
	Physical layout	All components must be easily accessible without having to de-install, disconnect or remove other components so that service can be easily accomplished.
	Size	Equipment footprint of less than 60 square feet in fully-scaled configuration.
	Standardized layouts	Components must be mounted in standardized configurations for all VA installations.
	Additional servers	Refer to Server Standard, Section Class C Server.
	Online maintenance	Ability to make hardware changes, repairs and expansion without impacting daily operations.

EXPLANATION OF STANDARD

Interoperability - Industry standards - for consistency and to ensure that the tape library provided meets the criteria set forth by both Industry Standards and the VA Standard a baseline of specifications are needed. These specifications are best indicated by the Storage Management Initiative Specification (SMI-S) which was developed by leading storage equipment and software providers.

Compatibility - Tape library must be capable of running multiple formats of tape drives in a single tape library in order to read previously written tapes. Minimum supported formats are DLT and LTO.

Backup SAN – It is preferred to have a dedicated SAN for backup traffic to reduce the impact of production performance. Backup traffic should be isolated from normal production LAN traffic.

Connectivity – Tape library must support a minimum of Fiber Channel, FICON, ESCON connectivity. Tape library must have minimum of supporting 4 Gb/second FC connectivity. An 8/GB FC connection is highly desirable.

Fully redundant configuration - Failure of a single component will not stop storage system operation in any capacity. Fully redundant system is critical to the continuing processing and to maintain system stability.

Current Generation Equipment - Tape libraries and/or components must not be listed on vendor websites as “End of Life” , “End of Sale” or ”End of Service Life”. The initial hardware general availability date should be less than 5 years from the proposal submission date.

Library Capacity (throughput) - Specification from market research needed for Enterprise Class Data Center environment.

Capacity (slots) - Specification from market research needed for Enterprise Class Data Center environment.

Scalability (throughput) - Specification from market research needed for Enterprise Class Data Center environment.

Scalability (slots) - Specification from market research needed for Enterprise Class Data Center environment.

Rack Configuration - Provide appropriate 4 posts (42 or 47 U) with sidewalls as specified by VA requirements

Manageable Power Supplies – Ability to manage thru an API or other standard interface from a remote location all power metrics of the PDU's.

Cooling – Tape library must be able to lose one fan without causing an outage or cause the system to be unstable.

Physical Layout – All components must be easily accessible without having to de-install, disconnect or remove other components so that service can be easily accomplished.

Size - Specification from market research needed for Enterprise Class Data Center environment.

Standardized layouts - The layout of the solution must be a consistent design that is in use at all datacenters that are keeping with VA standards. This approach allows for the redistribution of the equipment to different sites and the most efficient use of data center space.

Additional Servers – Refer to Server Standards, Section Class C Server.

Online maintenance - Ability to make hardware changes, repairs and expansion without shutting down the tape library system. The system has the ability to allow hot swapping of its hardware components, dynamic update of its firmware and software.

EVALUATION FACTORS

- Lowest Total Cost of Ownership (TCO) solution that meets the performance requirements is preferred. Components considered are small footprint, power consumption, cooling, Hardware, Software, license, Overhead cost of managing the devices, Ease of Management, Acquisition cost, Maintenance and deployment costs, storage capacity (such as number of data copies),Information Lifecycle Management(ILM) cost.
- **Interoperability – Industry standards** – REQUIRED the supporting documentation should be presented and validated during the acquisition process. These specifications are SMI-S v1.1 as described at: http://www.snia.org/forums/smi/tech_programs/smis_home/
- Tape Library drives must be capable of encryption. Both hardware and key management system must comply with FIPS 140-2 level 3 standards.
- **Compatibility** - Tape library must be capable of running multiple formats of tape drives in a single tape library.
- **Connectivity –** Tape library must have minimum of supporting 4 Gb/second FC connectivity. An 8/GB FC connection is highly desirable.
- Redundant components are needed to ensure the failure of one component of the tape system will not cause an outage.

IMPLEMENTATION GUIDANCE

Lowest Total Cost of Ownership (TCO) solution that meets the performance requirements is preferred.

Offload direct tape backup process from primary disks is recommended as it will have less impact to production performance and eliminates the backup window restriction.

Ensure solution has alternate way to store and retrieve data locally or remotely.

Interoperability – Industry standards - The standards which are provided in the sections above must be adhered to and validated during the implementation phase using the common set of tools identified in the SMI-S v1.1.

Backup SAN – Tape library should have dedicated SAN to isolate Backup traffic from normal production LAN traffic.

Redundancy **i**ncludes validation in acceptance testing**.** Component failure testing should occur prior to putting into production. This should include a planned failure of a single component to ensure the backup/ secondary component provides adequate coverage to verify no outage of the tape system.

Standardized layouts - Ensure that all layouts conform to VA Standard and are validated during installation.

3.5.5 [BACKUP SOFTWARE/VTL/ARCHIVE/TAPE LIBRARY TOOL]

STANDARD

ID	***Secondary Attribute***	***Specification***
	Backup Software	Provide Enterprise level backup software with ODBC and JDBC connectivity.
		Support Open VMS client and Open VMS Scripting is required
		Software with source and target Deduplication capability. Support Global Deduplication is preferred.
		Capable of synthetic backup
		NDMP backup and restore capable of performing block level backup and file level restore
		Capable of creating snapshots and clones. Support Continuous Data Protection (CDP)
	Tape Library management tool	Provide Enterprise level Tape Library management software. Compatibility with tape backup software. Listed on the VA Technical Reference Model (TRM) is preferred
	Encryption	Enterprise Backup software encryption and Enterprise encryption key management system complying with FIPS 140-2 level 3 standards without regard to application, operating system or primary storage device.
	Compatibility	Compatibility with operating systems listed on the VA Technical Reference Model (TRM)
	Scripting	Compatibility with operating systems listed on the VA Technical Reference Model (TRM)
	Proactive monitoring and remote notification	The software and management tool must be capable of proactive monitoring and remote notification of system and application health. Must support ODBC and/or JDBC connectivity.
	Role-based access	Solution must include security configurations that support role-based access required to limit functions during normal and COOP operation.

	Manageability	Manageable from a single application provided as part of the solution.
	Additional servers	Refer to Server Standard, Section Class C Server.
	Management server security	Refer to Server Standard, Section Class C Server.
	Consistent design	All software should use identical components where possible to facilitate common updates across the solution.

EXPLANATION OF STANDARD

Backup Software - Provide Enterprise level backup software with ODBC and JDBC connectivity. Must support Open VMS (**Open Virtual Memory System**), client and Open VMS (**Open Virtual Memory System**), Scripting. Software with source and target Deduplication capability. Support Global Deduplication (*DATA DEDUPLICATION WHICH REMOVES DUPLICATE DATA ACROSS MULTIPLE DEDUPLICATION SYSTEMS*) is preferred. Capable of synthetic backup(full and subsequent incremental backups). NDMP ***(Network Data Management Protocol)*** backup and restore capable of performing block level backup and file level restore. Capable of creating snapshots and clones with support for Continuous Data Protection (CDP).

Tape Library management tool - Provide Enterprise level Tape Library management software. Compatibility with tape backup software. Listed on the VA Technical Reference Model (TRM) is preferred.

Encryption - Enterprise Backup software encryption and Enterprise encryption key management system complying with FIPS 140-2 level 3 standards without regard to application, operating system or primary storage device.

Compatibility - Compatibility with operating systems listed on the VA Technical Reference Model (TRM)

Scripting - Compatibility with operating systems listed on the VA Technical Reference Model (TRM)

Proactive monitoring and remote notification - Backup software must be capable of monitoring and remote notification in the event of an alert, failure or the inability of the system to meet the customer's SLA's. Ability to send email or custom scripts or programs for notification.

Role-based access - Solution must include security configurations that support role-based access required to limit functions during normal and COOP(Continuity of Operations) operation.

Manageability - Manageable from a single application provided as part of the solution.

Consistent design - All software should use identical components where possible to facilitate common updates across the solution.

EVALUATION FACTORS

- Open VMS Support
- Continuous Data Protection

- Block Level Backups
- Snap shot capabilities
- Clone capabilities
- Remote Notification
- Scripting capabilities
- Encryption capabilities with FIPS 140-2 support

IMPLEMENTATION GUIDANCE

Implementation should include all optional software needed to meet the requirements listed above. Licensing and maintenance terms should the Hardware/Software Technical Support sections of this document. Professional implementation services should be included along with “classroom” training for support staff as outlined in the Training sections of this document.

3.5.6 [HARDWARE/SOFTWARE TECHNICAL SUPPORT]

STANDARD

ID	***Secondary Attribute***	***Specification***
	Support procedures	Documented support/escalation procedure for all components of the solution.
	Support Availability	Software support required 24x7x365 for all software provided in the solution. License and annual maintenance 3 years with 2 extension years.
		Hardware Maintenance/Support 5 yr, 24x7x365, 4 hour response time is required .
	License transfer	Licenses can be transferred without limitation within the Department of Veterans Affairs.
	OEM resources	Direct access to on-line OEM vendor support incident information and tracking.
	Support Interface	All VA datacenters must have access to incident information and tracking for all VA datacenters.
	Disruptive patches	Describe any type of updates/patch that would require a hosted service outage of the solution.
	SLAs	Documented Service Level Agreements (SLAs) for support requests.
	Professional services	Include cost of any professional services for services that must be completed by the vendor.

EXPLANATION OF STANDARD

Support procedures – A documented (digital & printed) set of instructions and escalation procedures to include updated contact information for the appropriate point of contact while troubleshooting problems. This will be a living document and as such digital copies should have supplements/replacements provided quarterly to ensure the most up to date procedures are available for the customer.

A concisely documented set of procedures is essential for communication between the customer and the support staff, allowing for all parties to know when priority escalation occurs, how it occurs, and the proper path for the expedited resolution.

Support Availability – Due to the criticality of these systems, full round the clock support is essential for a minimum of the first year, with options available to extend for the following four years allowing for a total of five years. In addition a minimal 4 hour response time in regards to hardware maintenance is required.

License transfer – All pertinent licenses must be capable of being transferred between various VA sites and cannot be restricted by location. Due to the nature of the OI&T structure for the VA licenses must be capable of being transferred within the various physical locations without restriction.

OEM resources – Direct communication paths to the knowledge experts of a product is key for fast response and ensuring the systems remain operational at the levels needed. Being required to go through middlemen in efforts to funnel trouble calls is not suitable to the nature of these systems.

Speaking directly with the product expert allows for potential miscommunication errors to be avoided. Being able to go directly to the appropriate level of tier knowledge on a failure is essential for ensuring that the problem is communicated correctly and quickly the best support engineer that can assist the customer.

Support interface – Due to many VA experts working across various regions and areas it is vital for all site's to be able to access VA wide information for troubleshooting and sharing of information.

VA I.T. support is organized through a central Office of Information Technology and is required to assist each various region/area as needed. Support contact and information should not be limited to a locality and must allow for access across the VA areas.

Disruptive patches – Ideally updates/patches will be able to be implemented with 0% system downtime. Any operations that would require a system outage needs to be documented and provided for review.

VA standards require that all disruptions be documented, submitted, and tracked to resolution. Known procedures that require disruption of service need to be documented and said documentation made available. Support engineers will need to work with VA staff to ensure that the required procedures for disruptions are followed.

SLAs - Documented Service Line Agreements (SLAs) for support request will be provided and the Vendor will ensure that there is no confusion between VA staff and Vendor on expectations.

Professional services – Provide a full disclosure of vendor specific services that must be provided by the vendor only. I.E. Some storage systems require a vendor engineer to flash firmware or similar upgrades and do not allow the customer to perform such actions.

VA standards require that outside contractors be escorted and/or evaluated for security requirements. All expected procedures that require vendor services need to be provided and a list of potential engineers that will be onsite updated as needed to ensure the engineer can gain access.

EVALUATION FACTORS

- Quality of documentation to include ease of finding information, extent of informative data, and usability in regards to trouble shooting and technical support will be considered.

- Direct phone contact for immediate escalation of troubleshooting over email, web interface, or other "automated" trouble shooting requests will be preferred.
- While direct access to product experts are needed, having a support engineer/contact to supervise and ensure that all experts are moving forward with the end goal of problem expedient problem resolution is preferred.
- Central/Single Interface for multiple sites to track VA related problems will be preferred.
- Minimum amount of scheduled downtime for patching/updating and supporting evidence for such is preferred.
- Path of communication for VA to suggest improvements and see improvements implemented is beneficial.
- Forums or other user group discussion areas are beneficial.
- Lower on-site response time is beneficial.
- Lower initial "engineer level" contact response time is beneficial.
- Lower time-to-repair is beneficial.
- Vendor-supplied components stocked as spares near, or at, facility is beneficial.
- Penalty clauses for vendor not meeting support contract provides is beneficial.

IMPLEMENTATION GUIDANCE

Coordination with initial VA staff for knowledge transfer and verified understanding is important. Continuing contact with VA staff to ensure support procedures are viable and procedures in place for VA input to improve support/product is essential.

3.5.7 [HARDWARE/SOFTWARE INSTALLATION]

STANDARD

ID	***Secondary Attribute***	***Specification***
	Installation	Provide hardware/software installation, including initial configuration, Storage Area Network configuration & knowledge transfer.
	Pre-configuration	Rack mount and configure the solution (including servers and storage where possible) prior to shipping it to the VA. This minimizes the on-site installation time as well as the number of crates and boxes that must be received and tracked by VA.
	Onsite impact	All on-site activities must be conducted in such a manner as to minimize the impact to normal information systems operations.
	Necessary software/hardware	Provide all necessary hardware and software, including all necessary cables and mounting hardware to make the Solution operational, except government-furnished property (GFP) referenced in GFP section.
	Delivery	Provide inside delivery, installation and insurance of all equipment to VA datacenters. The VA does not accept delivery of the equipment until acceptance testing is passed at all VA datacenters.
	Trash	Remove all trash associated with shipping, delivery and installation.
	OS installation and security	Refer to Server Standard, Section Class C Server.

EXPLANATION OF STANDARD

Installation - Provide planning, configuration and tentative schedule for the initial installation. This planning should involve collaborating with customer technical personnel to insure any and all critical elements and requirements regarding the environment are communicated. This process is envisioned as a collaborative effort between the vendor and customer with the end result being an installation that is 100 percent complete, functional and fully documented and the customer understanding everything needed to operate and maintain the system. This also includes demonstrating the steps necessary to backup and restore the system to a fully functional state. This entire process is to be conducted in such a manner as to minimize the impact to normal information systems operation.

Pre-configuration - To shorten the installation process and better utilize the time vendor personnel are on-site it is required pre-racking and pre-configuring the solution as much as possible prior to delivery. This includes working with customer personnel to develop any custom software images and preload the images prior to shipping.

Restorable images – In addition to having hardware preloaded with software a process must be in place to have restorable images for these systems as a backup to needing to overwrite/restore an existing image during install. Custom DVD's, portable storage, etc… are all viable options to having the image onsite for quick access and use.

Onsite impact – Minimal impact on the site facility is required. Efforts will be taken by the Vendor to ensure that the prep, assembly, install, and testing of the Solution will be done in a professional manner with minimal impact upon local site. Concern in regards to trash, path blockage, unsecured equipment, excessive levels of noise, etc… should be considered and action taken accordingly.

Necessary software/hardware – Aside from government-furnished property (GFP) referenced in the GFP section, all software and hardware required to make the Solution operational will be provided by the Vendor. This is to include but not limited to: cables, mounting brackets, screws, install software, testing equipment, etc…

Delivery – The Vendor will take responsibility of ensuring that all materials are delivered into the facility install location and the materials will remain the responsibility of the Vendor until acceptance testing is passed at all VA datacenters.

Trash – The Vendor will take responsibility of the removal of all trash from the facility, including but not limited to: boxes, packing materials, plastic bags, ties, etc…

OS installation and security – Following existing documentation provide by the VA Platform Server Team ensure all Operating systems and Security applications are installed accordingly.

EVALUATION FACTORS

- It is considered beneficial if the vendor can detail a delivery, installation and configuration plan for the equipment the vendor is proposing.
- Any demonstration that equipment can be pre-racked, pre-configured or pre-imaged is considered beneficial
- Verification that images can be restored onsite instead of remotely for install purposes is preferred.
- A basic plan to show minimal impact during installation and setup with certified technicians to follow this plan is preferred. Vendor hiring lowest cost "IT Talent" is not preferred.
- Checklists of hardware and software installation needs and verified availability of these is beneficial.

IMPLEMENTATION GUIDANCE

As much Vendor/VA staff preinstall communication to ensure full understanding is recommended.

Vendor verification of hardware fitting and requirements prior to install is required. Finding out at install that a piece of equipment does not fit or does not have all the install equipment is not acceptable.

All documentation, software, and hardware required for installation and operation of the Solution as well as training materials need to be onsite and verified for installation.

3.5.8 [TRAINING]

STANDARD

ID	*Secondary Attribute*	*Specification*
	Training Length	Provide equivalent of one day of certified vendor classroom training for every installed tape drive or every 12TB of VTL and Archive storage space.
	Knowledge transfer	Work with VA staff as activities occur to ensure that VA can assume operational responsibility for the delivered solution.
	Documentation	Provide electronic copies of all materials, manuals, worksheets, etc. used in the delivery of the solution.

EXPLANATION OF STANDARD

Training Length – An initial complete training for VA staff is important for this project to succeed. An equivalent of one day of certified vendor classroom training for every installed tape drive or every 12TB of VTL and Archive storage space, or more if the vendor believes this is needed.

VA support staff must have a level of trained knowledge provided to allow them to operate at a high level of expertise for day to day operations and standard problem resolution.

Knowledge transfer – While classroom training is important for the understanding of principles and procedures, actual knowledge transfer in regards to the implemented packages, how they work in the VA environment and potential improvement that may be available or upcoming is required.

Documentation – Initially all documentation for training, materials, worksheets, etc… for the initial installation must be provided in electronic format to ensure standard knowledge for all VA staff. As the product is changed and improved future training and documentation will also need to be provided.

Training documentation must be as complete as possible to allow for new VA staff to be able to understand and work with the vendor product.

EVALUATION FACTORS

- Vendor specific training that is oriented towards certification or “engineer” level training that is pertinent to properly managing and troubleshooting the product is preferred.
- Additional time/effort spent working with VA staff to ensure that the VA environment is optimized and meeting VA expectations is beneficial.
- When directly training VA staff printed as well as digital materials is beneficial to allow full potential of learning from staff.
- User forums for exchange of ideas and knowledge are preferred.

IMPLEMENTATION GUIDANCE

Any implementation that requires a strong base of knowledge for VA staff needs to have a planned training event set in place prior to installation to allow for full VA understanding and best potential for project implementation. While this training should be prior to installation it must not be so far in advance that newly learned skills/knowledge will become stale/obsolete by installation time.

In addition any installation that will occur near a time of a new patch or revision needs to ensure that the new knowledge is provided with the training.

4 TAXONOMY OF STANDARDS

A. Taxonomy of Tier1 Storage Standards, the followings are primary and secondary attributes used in this standards document.

ID	*Primary Attribute*	*Secondary Attribute*
1	Storage Subsystem Hardware (HW)	Workload
		Minimum IO/sec
		Minimum Throughput
		Storage unit uptime
		Universal Device ID value (UDID)
		Redundancy
		FC - Hosts to Storage Connectivity
		iSCSI - Hosts to Storage Connectivity
		FICON connectivity
		SCSI Initiator (Host Connections)
		Replication
		LUN creation
		LUN Expansion
		Storage provisioning
		Tiering capability
		Resource partitioning capability
		Dynamically tuning
		Backend Storage virtualization
		Snapshots
		Clones
		Storage device scale up capability
		Supported Disk type

		Return disk option
		Interoperability - Industry standards
		Firmware and microcode upgrade or updates
		Boot from SAN
		Operating system and file system compatibility
		Applications compatibility (minimum)
		Redundant Array of Independent Disk (RAID) levels
		RAID group size
		Power switches
		Standardized layouts
		Additional servers
		Role-based access
		Documentation
2	Mainframe support	Parallel Access Volume (PAV)
		FICON support
		HiperPAV support
		SMF support
		Emulation types
		Solid State devices (SSD) support on Mainframe
		Dynamic Channel Reconfiguration support
		MIDAW support
		Priority I/O Queuing
3	Storage Management Software	Enterprise license not based on capacity
		Interoperability
		Storage Reporting

		Automated tools for LUN provisioning
		Proactive monitoring and remote notification
		Single storage management console
		Additional servers
		Management server security
		Data snapshot (local)
		Performance analysis
		Storage Capacity planning
		Local copy
		Consistent design
4	Hardware/Software technical support	Support procedures
		Support Availability
		License transfer
		OEM resources
		Support Interface
		Disruptive patches
		SLAs
		Professional services
5	Hardware/software Installation	Installation
		Pre-configuration
		Onsite impact
		Necessary software/hardware
		Delivery
		Trash

		OS installation and security
6	Training	Training Length
		Knowledge transfer
		Documentation

B. Taxonomy of Tier2 and Tier3 Storage Standards, the followings are primary and secondary attributes used in this standards document.

ID	***Primary Attribute***	***Secondary Attribute***
1	Storage Subsystem Hardware (HW)	Workload
		Minimum IO/sec
		Minimum Throughput
		Storage unit uptime
		Universal Device ID value (UDID)
		Redundancy
		FC - Hosts to Storage Connectivity
		iSCSI - Hosts to Storage Connectivity
		SCSI Initiator (Host Connections)
		Replication
		LUN creation
		LUN Expansion
		Storage provisioning
		Tiering capability
		Deduplication
		Snapshots
		Clones
		Storage device scale up capability
		Supported Disk type

		Return disk option
		Interoperability - Industry standards
		Firmware and microcode upgrade or updates
		Boot from SAN
		Operating system and file system compatibility
		Applications compatibility (minimum)
		Redundant Array of Independent Disk (RAID) levels
		RAID group size
		Power switches
		Standardized layouts
		Additional servers
		Role-based access
		Documentation
2	Storage Management Software	Enterprise license not based on capacity
		Interoperability
		Storage Reporting
		Automated tools for LUN provisioning
		Proactive monitoring and remote notification
		Single storage management console
		Additional servers
		Management server security
		Data snapshot (local)
		Performance analysis

		Storage Capacity planning
		Local copy
		Consistent design
3	Hardware/Software technical support	Support procedures
		Support Availability
		License transfer
		OEM resources
		Support Interface
		Disruptive patches
		SLAs
		Professional services
4	Hardware/software Installation	Installation
		Pre-configuration
		Onsite impact
		Necessary software/hardware
		Delivery
		Trash
		OS installation and security
5	Training	Training Length
		Knowledge transfer
		Documentation

C. Taxonomy of STORAGE AREA NETWORK (SAN) Standards, the following is primary and secondary attributes used in this standards document.]

ID	*Primary Attribute*	*Secondary Attribute*
1	LAN Connectivity	IP Connectivity between Hosts and Storage device
2	Fabric switch hardware (HW)	Fabric Connectivity between Hosts and Storage device
		Interoperability
		Fabric Isolation
		Capacity “Throughput”
		Capacity “Ports”
		Port virtualization
		Manageability
		Fully redundant configuration
		Oversubscription
		Fabric
		Automated monitoring
		Current generation equipment
		Additional ports
		Rack Configuration
		Manageable power supplies
		Cooling
		Physical layout
		Standardized layouts
		Additional servers
		Role-based access
3	SAN Management Software	Management Software
		SAN Reporting

		Proactive monitoring and remote notification
		Performance monitoring
		Single SAN management console
		Additional servers
		Management server security
		Consistent design
4	Hardware/Software technical support	Support procedures
		Support Availability
		License transfer
		OEM resources
		Support Interface
		Disruptive patches
		SLAs
		Professional services
5	Hardware/software Installation	Installation
		Pre-configuration
		Onsite impact
		Necessary software/hardware
		Delivery
		Trash
		OS installation and security
		Single-initiator zoning
6	Training	Training Length
		Knowledge transfer

		Documentation

D. Taxonomy of General Backup and Archive standard, the followings are primary and secondary attributes used in this standards document.

ID	*Primary Attribute*	*Secondary Attribute*
1	Backup Method	Tape
		Disk (Tapeless)
		Archive
2	Virtual tape library (VTL) hardware	Technology
		Disk health monitoring
		Deduplication
		Replication
		Raw Storage Capacity
		Number of Emulated Tape Libraries
		Number of Emulated Tape Drives
		Number of Virtual Tape Cartridges
		Connectivity
		Redundancy
3	Archive Hardware	Technology
		Disk health monitoring
		Data Storage Architecture
		Deduplication
		Replication
		Protocol Support
		Number of Files
		File Size

		Raw Storage Capacity
		Number of drives
		Connectivity
		Redundancy
4	Tape Library hardware	Interoperability - Industry standards
		Compatibility
		Backup SAN
		Connectivity
		Fully redundant configuration
		Current generation equipment
		Library Capacity (throughput)
		Capacity (slots)
		Scalability (throughput)
		Scalability (slots)
		Rack Configuration
		Manageable power supplies
		Cooling
		Physical layout
		Size
		Standardized layouts
		Additional servers
		Online maintenance
5	Backup Software/VTL/Archive/ Tape library tool	Backup Software
		Tape Library management tool
		Encryption
		Compatibility

		Scripting
		Proactive monitoring and remote notification
		Role-based access
		Manageability
		Additional servers
		Management server security
		Consistent design
6	Hardware/Software technical support	Support procedures
		Support Availability
		License transfer
		OEM resources
		Support Interface
		Disruptive patches
		SLAs
		Professional services
7	Hardware/software Installation	Installation
		Pre-configuration
		Onsite impact
		Necessary software/hardware
		Delivery
		Trash
		OS installation and security
8	Training	Training Length
		Knowledge transfer
		Documentation

APPENDIX A – DEFINITIONS

APPENDIX B – REFERENCES

APPENDIX C – ACRONYMS

Refer to the VA Acronym Lookup Web page for a list of VA specific acronyms.

EIE VA OI&T Enterprise Infrastructure Engineering

Click here to enter additional acronyms.

APPENDIX D – CONTRIBUTORS

The following subject matter experts have contributed to the development of this document as indicated

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